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TENANCY IN THE UNITED STATES, 1865–1900

A Consideration of the Validity of the Agricultural Ladder Hypothesis

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The intention of this study is to challenge the widely accepted hypothesis that the agricultural ladder was the dominant and most significant pattern in the rural life of the United States during the period, 1865–1900.[1] The progression from farm laborer to tenant to owner as a basic pattern is simply too neat a formula to explain complex historical phenomena. Its essential accuracy is open to question from several points of attack. Its utility is even more questionable, for the prevailing acceptance of this hypothesis has tended to discourage rather than to provoke detailed and careful historical investigation. Its basic assumptions, deep rooted in American tradition, as to ownership and opportunity for economic advancement, are value judgments which may, or may not, be justified. It is, therefore, important to examine the historical functioning of these assumptions.

Scholars in fields other than history have been chiefly responsible for the formulation of the agricultural-ladder doctrine and have utilized it more consciously than historians. Nevertheless, the work of the historians has been influenced by an acceptance of the formula.

The treatment of tenancy in histories of American economic development illustrates the influence of the ladder concept. One textbook speaks of the widespread alarm over the extent of tenancy revealed by the 1880, 1890, and 1900 censuses, but concludes that "Tenancy indicated the endeavor of ambitious farm laborers and persons of small means to make themselves independent rather than the fall of unsuccessful owners to the rank of tenants."[2] Similarly a second text attributes the increase in tenancy in part to the inability of the poor man to meet the costs of expensive machinery and higher-priced land but adds: "On the other hand, it should be pointed out that the growth of tenancy may be an encouraging sign, for to many men tenancy is a step toward ultimate ownership."[3] After a more extensive survey of farm tenancy development and of sectional differences in its growth, a third text repeats the familiar explanation in respect to the growth of tenancy in the wheat and corn belts before 1920. "Tenants were so only in transition. Some were brothers, sons, or other relatives who would step into the property when the owner died; others were accumulating the money necessary to make the final payments on the farm; most were young men who would become owners when they were older. In brief, there was a tenure ladder which led upward."[4]

To cite these passages is not to point the finger of criticism. They merely illustrate the fact that historians have been influenced by the formulations and explanations which have been set forth often and elaborately by the agricultural economists and rural sociologists. The truth of the matter is that except in respect to the South there is a dearth of historical studies on farm tenancy. Of the forty-eight items on farm tenancy and rural population listed in Everett E. Edwards' *Bibliography of the History of Agriculture in the United States* not one appeared in a historical journal, and the neglect of the field by the historical profession has not been substantially remedied since the publication of that excellent guide. Notable exceptions, of course, are the pioneering studies by Paul W. Gates. In all fairness, it should be pointed out that agricultural economists have shown a very real awareness of and interest in the historical roots of tenancy. They have proposed its historical investigation in their formulations of needed research, and they

[1] This paper was presented under the title, "Tenancy: A Step Toward Farm Ownership? (1865–1900)," at the session of the Agricultural History Society with the American Historical Association in New York City on Dec. 29, 1943.

[2] Ernest L. Bogart, *Economic History of the American People*, 520–521(ed. 2, New York, 1935).

[3] Harold U. Faulkner, *American Economic History*, 394(ed. 5, New York, 1943).

[4] Edward C. Kirkland, *A History of American Economic Life*, 476(New York, 1939).

have frequently analyzed contemporary tenancy problems with the nineteenth century as a point of departure.[5] Their studies include material helpful and suggestive to historians, but they are based too extensively, indeed in many instances exclusively, on census figures to constitute a substitute for intensive historical research.

That the historian's neglect has been due to an acceptance of the hypothesis of the agricultural ladder is not, of course, a proposition susceptible of absolute proof. Yet no one who delves into the history of tenancy in the last decades of the nineteenth century will find it easy to deny the inference. Particularly is this true in the light of the wealth of material on the economic basis of the movements of farm protest during the period, materials which one would expect to have piqued the historian's curiosity.

It was not the historians, then, who marshalled the evidence to show the workings of the agricultural ladder. Although the idea was already common currency as a reassurance to those who had been alarmed by the extent of tenancy revealed in the 1880 and subsequent census statistics—figures which seemed to belie the American faith in opportunity for economic advancement upon the land—the documentations of the ladder hypothesis did not begin to appear until the second decade of the twentieth century.[6] The agricultural economists in that decade and in the twenties were disturbed by the obstacles which confronted the young farmer who desired to attain farm ownership. They attributed his difficulties largely to the increased cost of land and compared his opportunities unfavorably with those that were available to farm laborers and tenants in earlier decades.

The very circumstances in which these early studies appeared should evoke the caution of the historian. In other words, the hypothesis was crystallized in a period when agriculture, being in a relatively advantageous condition as compared to industry, was in a very different relationship to the rest of American economy than it had been earlier. Agricultural prices and wages in the first two decades of the twentieth century were outdistancing the advances in industrial prices and wages, whereas in the period after the Civil War and before the turn of the century, the farmer and farm wage earner had been at a disadvantage. The drastic drop in farm prices during the earlier period is well known; the money wages of farm laborers declined more precipitously than did those of non-farm workers after the close of the Civil War, and the gains in real wages for farm labor lagged behind those for industrial labor.[7] The agricultural economists, however, were concerned not with the problems confronting the ambitious young farmers of earlier decades, but with those that seemed to menace their contemporaries. It ought to occasion no surprise if their backward glance should be shown to have been distorted by the roseate hue that so commonly tends to obscure the realities of the past.

It is not the intent of this paper to deny that there were tenants who did acquire the status of farm owner nor to determine the number of those who succeeded in making the transition. Its purpose, rather, is to arouse a spirit of critical inquiry as to the assumptions of the ladder hypothesis and to cast suspicion upon its validity as applied to the last half of the nineteenth century. The proponents of the theory must be faced in their home territory, the corn and wheat belt of the North. That the agricultural ladder did not work in respect to the cotton plantation regions and the freedmen is, of course, a fact well known and readily accepted. However, the South can not be summarily dismissed. At the time of emancipation, the idea of advance to ownership through tenancy was not prevalent—for Americans were yet to be made aware of tenancy by the census figures of 1880—but the assumption of the desirability and easy achievement of farm ownership was common.

[5] For examples, see Henry C. Taylor, *Agricultural Economics*, 238–269(New York, 1919); William Ten Haken, "Land Tenure in Walnut Grove Township, Knox County, Illinois, "*Journal of Land and Public Utility Economics*, 4:13–24, 189–198(1928); Carl F. Wehrwein, "The 'Agricultural Ladder' in a High Tenancy Region," *ibid.*, 7:67–77(1931); John D. Black, ed., "Research in Agricultural Land Tenure: Scope and Method," Social Science Research Council, *Bulletin 20*(1933); and H. C. M. Case, "Work and Plans of the North Central Regional Land Tenure Committee," *Journal of Farm Economics*, 25:258–268(1943).

[6] For examples, see W. J. Spillman and E. A. Goldenweiser, "Farm Tenantry in the United States," U. S. Dept. of Agriculture, *Yearbook*, 1916, p. 321–346; William J. Spillman, "The Agricultural Ladder," *American Economic Review Supplement*, 9:170–179(1919); and L. C. Gray, and others, "Farm Ownership and Tenancy," U. S. Dept. of Agriculture, *Yearbook*, 1923, p. 507–600.

[7] See the author's forthcoming *Agricultural Labor in the United States, 1865–1900, with Special Reference to the South.*

This belief was an important factor in the failure of the national government to adopt a program to assist Negroes in acquiring land ownership. At the inception of Reconstruction, the Negro's northern friends believed that his economic problem would be readily solved if only he were given " 'a fair chance' "—that is to say "just rights of person and property" and "a fair and equal administration of justice."[8] Many confidently expected that the freedman would pull himself up to the status of farm owner with the savings from his wages. Officials of the Freedmen's Bureau and northern friends showered the Negro with admonitions to work industriously and to save as the best way to achieve land ownership.[9] When the antislavery leaders added the demand for suffrage, they characterized it as the "one vital issue. . . . All other questions are unimportant or will easily settle themselves."[10] This contention was made despite their own slogan of "land, education, and the ballot." When they finally marshalled their forces behind a constructive and non-vindictive proposal for government aid in financing land ownership for Negroes, they met opposition even from liberals and humanitarians based upon the belief that all the freedman needed was "manly self-reliance and a spirit that asks help of no man and no treasury."[11] These were the words of Horace Greeley, confident of the opportunities in the West. To the land proposal he raised the answering cry "Root, hog, or die"; and his conviction could not be shaken even by the bitter retort of Wendell Phillips that he would like to "strip HORACE GREELEY, and put him out upon the prairie, and say to him 'Root, hog, or die.' "[12] In the sixties the tendency to view American economic life as one of opportunity, which would yield wealth and security in just proportion to a man's diligence, was instinctive and widespread. This assumption in respect to American agricultural life prior to the opening of the twentieth century (and the concept of the agricultural ladder is but a variant of this faith) has been persistent and almost unchallenged. That it should have played an important role in determining the policy which was to fasten tenancy upon the South suggests the need for careful appraisal of the idea as a functioning historical force.

There is no need to belabor the point that tenancy in post-Civil War cotton areas did not prove to be a rung on the agricultural ladder, since this fact has been generally recognized and most students have been careful to except the section in their generalizations about the ready advance through tenancy to ownership. However, one aspect of tenancy development in the old plantation black belt casts doubt that need not be sectionally delimited upon a refinement of the theory. According to the ladder formula, transition from share to cash tenancy is an intermediary step up the ladder. Analysis of tenure statistics for selected counties in South Carolina, Georgia, Louisiana, and Mississippi which have been the heart of the ante-bellum cotton plantation economy and whose population remained predominantly Negro even after the turn of the century discloses a remarkable increase in the number and percentage of money tenants between 1890 and 1900. For example, according to the Census, in seventeen Georgia counties there were 5,672 farms operated by money tenants in 1890; in 1900 they numbered 9,047—an increase from 30 to 48 percent of the number of all farms. The number of share-tenant (or sharecropper) farms dropped from 12,614 to 9,605 during the decade. Similarly eleven central Alabama counties gained 17,186 farms operated on money tenure and lost 2,867 share tenant farms. This would seem to indicate an advance for large numbers of Negro farm workers, yet the economic condition of tenant farmers in the nineties was desperate. They sank farther and farther into debt. Cotton prices were extremely low, falling even below 5 cents a pound. For large numbers of producers cotton was being raised at cost or below. In the significant understatement of one planter, when cotton sold at 4, 5, or 6 cents a pound "the tenants had to live very hard."[13] In 1899, the year that marked an upturn in cotton prices, the average value of products on Negro farms in Georgia not fed to livestock was $328 and in Alabama $286.[14]

The change in tenure accompanied the low prices

[8] 38 Congress, 1 Session, "Preliminary . . . and . . . Final Report of the American Freedmen's Inquiry Commission," *Senate Executive Document* 53, p. 110(1864).

[9] For example, see 39 Congress, 1 Session, "Freedmen's Bureau," *House Executive Document 70*, p. 4–5 (1866).

[10] Editorials in *National Anti-Slavery Standard*, May 26, July 16, 1866.

[11] New York *Tribune*, Dec. 14, 1869, p. 4.

[12] New York *Times*, Jan. 29, 1870, p. 4.

[13] U. S. Industrial Commission, *Report*, 10:507(Washington, 1901).

[14] U. S. Census Office, Twelfth Census, 1900, Agriculture, 5:cix.

of the nineties because landowners, including new purchasers from the ranks of the local merchants or cotton factors, and operating plantation owners of the eighties, who moved to town in search of occupation to supplement their farm incomes, made it a policy to lease their lands for a fixed money rental.[15] They were pushing the farm laborer nominally up the agricultural ladder in order that he might absorb a greater share of the risk and losses incident to cotton production. Land operated by sharecroppers and share tenants represented a greater risk—probably a financial liability—than land which brought a fixed money rental. When higher prices again made cotton production profitable in the decade from 1900 to 1910, the tendency was to displace renters with share tenants, croppers, and hired laborers. The relationship between share and money tenure must be studied in its historical setting before these so-called rungs of the agricultural ladder can be given any meaning in terms of the status of the operating farmer.

What of the tenant farmer in the northern corn and wheat states during the decades of the seventies, eighties, and nineties? Was he advancing steadily upward? Certainly farm conditions were not propitious for his ascension. The period was one of falling prices and hard times, conditions that bred the Granger movement, the Greenback agitation, and the Populist revolt. The Illinois Board of Agriculture estimated that farmers had received a profit on corn in only ten of the twenty-four years from 1870 to 1893 and that they had lost money on wheat in more than half of the fifteen years from 1880 to 1894.[16] The cost of producing wheat in Kansas and the Dakotas was reported to have been above the average selling price for nine of the ten years preceding 1894. In 1884 Dakota farmers were complaining that wheat prices were 20 percent below the cost of production.[17] Of the 1,015 Iowa farmers who made returns to the state bureau of labor statistics in 1890, 860, or 85 percent, reported that the local market price of farm produce from January 1885 to January 1890 had been below cost; 6 percent reported the market price to have been at cost; and only 9 percent stated that it had been above production costs.[18]

High interest rates and inadequate credit facilities plagued the western farmer. These were important considerations for the tenant struggling to lay something by or contemplating the venture into mortgaged ownership. In the newer regions particularly, interest rates reached usurious heights; they were as much as 24 percent even on real estate mortgages, and nominally moderate rates were augmented by penalties and bonuses. Chattel mortgages brought consistently high returns to lenders. The connection between the Granger movement and the credit problem has been well established. In the lean years of the seventies and again in those of the late eighties and the nineties, farmers found it difficult to obtain advances at any rate of interest, and the easy credit thrust upon them by the representatives of eager eastern investors in the years of good prices and rising land values of the early eighties was no unmixed blessing. The heavy weight of indebtedness bore down upon the borrowers when the bad years came.[19]

Indeed, the shift from tenancy to ownership can be realistically evaluated only in terms of permanent ownership. The fact that the agricultural ladder operated in the reverse direction has been all too summarily noted and put aside by those who deal with the ladder hypothesis. Historical studies of the economic conditions of the western farmer suggest that backsliding may have been a major

[15] *Ibid.*, 6:409; Robert P. Brooks, *The Agrarian Revolution in Georgia, 1865–1912*, p. 88(Madison, Wis., 1914); Eugene C. Brooks, *The Story of Cotton*, 207(Chicago, 1911); and Charles W. Burkett and Clarence H. Poe, *Cotton: Its Cultivation, Marketing, Manufacture, and the Problems of the Cotton World*, 39–41(New York, 1906).

[16] Ernest L. Bogart and Charles U. Thompson, *The Industrial State, 1870–1893*, p. 234, 237(*Centennial History of Illinois*, v. 4, Springfield, 1920).

[17] Hallie Farmer, "The Economic Background of Frontier Populism," *Mississippi Valley Historical Review*, 10:418, 419(1924).

[18] Iowa Bureau of Labor Statistics, *Biennial Report*, 1890–91, p. 53.

[19] Arthur F. Bentley, *The Condition of the Western Farmer*, 31, 43(Baltimore, 1893); Solon J. Buck, *The Granger Movement*, 23(Cambridge, Mass., 1913), and *The Agrarian Crusade*, 19–21(New Haven, 1920); Farmer, "Economic Background of Frontier Populism," 419; Harold E. Briggs, "The Development of Agriculture in Territorial Dakota," *Culver-Stockton Quarterly*, 7:8(1931), and "Grasshopper Plagues and Early Dakota Agriculture, 1864–1876," *Agricultural History*, 8:57(1934); Herbert S. Schell, "The Grange and the Credit Problem in Dakota Territory," *ibid.*, 10:63 (1936); Everett Dick, *The Sod-House Frontier, 1854–1890*, p. 96(New York, 1937); and John D. Hicks, *The Populist Revolt*, 21(Minneapolis, 1931).

factor in many localities. Grasshopper plagues, droughts, the downward spiraling of prices, the periods of general depression,—all broke the hold of many a man upon his land. In the seventies, hundreds of debt-ridden Iowa farmers left their lands and frequently were mistaken for vagabonds.[20] The situation was worse in Kansas and Nebraska where, in the words of one authority, frontier counties "felt this depression more severely than older ones because there was no considerable store of accumulated savings with which to meet it."[21] Even in Wisconsin, farmers whom the panic had found in debt lost their farms and moved on.[22] Mortgage foreclosures and forced sales in great numbers accompanied the crop failures and falling prices of the late eighties and nineties. Kansas is said to have lost nearly 180,000 persons between 1887 and 1891.[23] According to one student, half the population of the western part of the state trailed eastward between 1888 and 1892.[24] A contemporary estimated that two and a half settlers occupied Nebraska homesteads before one came who was able to stay.[25]

Stories of failure came out of the recently settled areas beyond the Mississippi; but to the aspiring tenant in the older states of the Midwest farm ownership may well have appeared less readily attainable at home than farther west. At home, land was no longer cheap. Expensive machinery or other large investments, as for dairying, were increasingly necessary for successful farming. In 1885 an Illinois crop correspondent wrote: "The farm work is mostly done by expensive machinery, and those unable to own such machinery, being unable to compete with the others, find it more profitable to hire out than to farm on their own account."[26] After 1880 the rural population of Michigan decreased, intensive farming increased, and by 1885 it was recognized that there existed "an absence of facilities for advancing in the 'profession.' "[27] In Iowa the eighties witnessed what one historian of the Populist movement termed an "agricultural transformation," with farming "becoming more and more a matter of capital, business and scientific methods."[28]

If tenancy in this period was—as many have held—primarily a healthy medium through which the farm worker could acquire sufficient funds to meet the increasing cost of land and equipment, it might be expected to recede gradually before the advance up the agricultural ladder in the areas where it was concentrated. However, in areas where tenancy was high in 1880 or 1890 it tended to remain high. Thus, of the seven Iowa counties with the highest rate of tenancy in 1880, everyone had a still higher percentage of tenants in 1900; and in that year (and also in 1910) all save one had a tenancy rate well above the average for the state as a whole. Similarly the ten Illinois counties with the highest percentage of tenant farms in 1890 showed an increase of tenancy from 47.8 to 54.2 percent during the decade, an increase of 6.4 points as compared to 5.3 (from 34 to 39.3 percent) for the state.[29] In just one of the Illinois counties was there a slight drop in the percentage of tenancy. Obviously, tenancy was not preparing the way for ownership in these areas.

When writers compare the tenancy trends before and after 1900, they generally point to the availability of free or cheap lands in the earlier period and the ease with which the young tenant in the more settled areas who had no prospect of an inheritance could settle upon the public domain. If they searched the records they could undoubtedly find many instances of such migration and settlement to buttress their point. Their generalizations, however, fail to take into account two fac-

[20] John E. Briggs, "The Grasshopper Plagues in Iowa," *Iowa Journal of History and Politics*, 13:370 (1915).

[21] Addison E. Sheldon, *Land Systems and Policies in Nebraska*, 106–107(Lincoln, 1936); Bentley, *Condition of the Western Farmer, 62.*

[22] 46 Congress, 2 Session, "Investigation by a Select Committee of the House of Representatives Relative to the Causes of the General Depression in Labor and Business . . .," *House Miscellaneous Document 5*, p. 21, 366(1879).

[23] Farmer, "Economic Background of Frontier Populism," 421.

[24] Raymond C. Miller, "The Background of Populism in Kansas," *Mississippi Valley Historical Review*, 11:477(1925).

[25] Dick, *Sod-House Frontier*, 97.

[26] U. S. Dept. of Agriculture, Bureau of Statistics, n. s., *Report* 18, p. 29(1885).

[27] *Ibid.*, 26. See also Romanzo Adams, "Agriculture in Michigan: A Sketch, "Michigan Political Science Association, *Publications*, 3(7):23(Ann Arbor, 1899).

[28] Herman C. Nixon, "The Populist Movement in Iowa," *Iowa Journal of History and Politics*, 24:5(1926).

[29] Based on the census. The Iowa counties were Butler, Fremont, Grundy, Ida, Mills, Poweshiek, and Scott. The Illinois counties were Christian, Ford, Grundy, Livingston, Logan, Madison, Marshall, Mason, Piatt, and St. Clair.

tors—the difficulties of maintaining a foothold on the public lands of the last frontiers and the extent to which good agricultural lands were held by railroads and speculators. Historical studies, such as the article by Paul W. Gates on "The Homestead Law in an Incongruous Land System," have called attention to the fact that much of the public domain was never accessible to the homesteader.[30] Fraudulent practices, huge land grants to railroads and states, continuance of cash sales, issuance of large quantities of land scrip, and persistent activity of land speculators consumed great tracts of the best arable public lands of the Mississippi Valley before 1880. Poor homeseekers were often faced with the alternatives of paying a good price for speculatively held lands, becoming tenants, or seeking homesteads upon inferior lands. The study of farm conditions in Harrison Township, Hall County, Nebraska, published by Arthur F. Bentley in 1893, convincingly documents the thesis that purchase from railroads or land speculators was a tremendous handicap to those seeking to maintain farm ownership. The average debt per acre of those farmers who had purchased their lands from individuals was $9.38; for those who had acquired their holdings from railroads it was $7.80 an acre. In contrast, the debt of settlers who had taken up government lands was only $3.09 per acre. Bentley expected that some of the second group would be able to extricate themselves but that most of the first group would have to give up their holdings within a short time.[31]

In a series of convincingly documented studies Paul W. Gates has pointed out the intimate relationship between the growth of tenancy in the prairie states of Indiana, Illinois, and Iowa and the activities of land speculators, loan sharks, large-scale farmers, and persons selling landed estates.[32]

[30] *American Historical Review*, 41:652–681(1936).

[31] Bentley, *Condition of the Western Farmer*, 67–68.

[32] "Land Policy and Tenancy in the Prairie Counties of Indiana," *Indiana Magazine of History*, 35:1–26 (1939); "Land Policy and Tenancy in the Prairie States," *Journal of Economic History*, 1:60–82(1941); and "The Role of the Land Speculator in Western Development," *Pennsylvania Magazine of History and Biography*, 66:314–333(1942).

Roy M. Robbins, *Our Landed Heritage*, 271–276 (Princeton, N. J., 1942), considers the extent of tenancy and the controversy over landlordism in the 1880s. See also David M. Ellis, "Land Tenure and Tenancy in the Hudson Valley, 1790–1860," *Agricultural History*, 18: 75–82 (April 1944).

Non-operating owners in some instances introduced tenancy deliberately as a permanent or temporary policy. Even where this was not the case, the higher cost of land and the onerous debt burden incident to their activities turned the sod for the seeds of tenancy. Although these activities were concentrated in certain localities, they can not be dismissed as exceptional and incidental. A study of the land policies in Nebraska, the state west of the Mississippi with the highest percentage of farm tenancy in 1900 (Illinois had the highest percentage of any state to the east) discloses that fully half of the public domain was "given or granted to railroad corporations, land speculators, and bogus entrymen with no purpose of permanent settlement."[33] Moreover, after the depression of the seventies, speculators were busy picking up bargains.[34] The role of the speculator and money lender has not been recognized by those who view nineteenth-century tenancy as an easy road to farm ownership, and it is difficult to see how their importance can be accepted without a major qualification of the ladder hypothesis.

Tenancy statistics in themselves should give pause to those who regard the period under consideration as a golden age for aspiring farm tenants. In 1880, the first year for which these statistics are available, over 20 percent of the farms of the East North Central states (Wisconsin, Michigan, Illinois, Indiana, and Ohio) and the West North Central states (the Dakotas, Kansas, Nebraska, Missouri, Minnesota, and Iowa) were operated by tenants. The rate of tenancy was 31.4 percent in Illinois and 18 percent in Nebraska. In the decade between 1880 and 1890, the number of tenant farmers in the West North Central states increased 49.9 percent. In the nineties, the increase in numbers was 43.4 percent. In the East North Central states the percentage increases were 14.4 and 29.4 percent. Here, in the nineties, the greatest increases in tenants per thousand farmers came in the age group of those 45 to 54 years old.[35] Of all Illinois tenants almost 26 percent were 45 years of age or over in 1890. A considerably greater number, 37 percent of the total, were 40 or older.[36]

[33] Sheldon, *Land Systems*, 302.

[34] *Ibid.*, 107–108.

[35] E. A. Goldenweiser and Leon E. Truesdell, "Farm Tenancy in the United States," U. S. Bureau of the Census, *Census Monograph 4*, p. 23–24,90(1924).

[36] Based on the U. S. Census Office, Eleventh Census, 1890, "Report on Farms and Homes," 216.

The formulators of the agricultural-ladder theory relied heavily upon the census data concerning the age of tenants as compared to the age of owners. The tabulations disclosed that whereas the percentage of tenants among farm operators under 25 years of age was extremely high, it diminished with each successive age group until tenants became a small proportion of farm operators 65 years of age and over. According to W. J. Spillman and E. A. Goldenweiser in the Department of Agriculture *Yearbook* for 1916, these figures showed clearly that "tenant farming represents a step toward ownership," and unquestionably indicated that "by far the greater proportion of young men who start out as tenants succeed in becoming owners."[37] Actually, these figures only show that the older men left on the farm were predominantly owners. They do not take into account the possibility that many former tenants may have failed to establish themselves as owners, slipped down the ladder to the status of farm laborers, sought a brighter future in the cities, or been eliminated otherwise. The authors of subsequent studies were more cautious in drawing conclusions from these statistics but continued to use them as evidence of the functioning of the agricultural ladder.[38]

The number of tenants who succumbed to the lure of the metropolis will never be known, but the migration from country to city in the eighties and nineties is an important historical fact. Throughout those decades, there was constant complaint that those who had formerly worked for hire upon the farms were departing to seek jobs in industry. A survey of Wisconsin farmers disclosed that the great majority of native farm wage earners desired to leave the farm for the city even in the depression years of the nineties.[39] After 1880 the city was functioning as the safety valve for farm labor—not the farm for city labor.

Another imponderable that casts doubt upon any sweeping generalizations based upon the tenant age statistics is the number of new farm owners during the period who acquired their lands without serving an apprenticeship as tenants. The investigations made in the 1920s and later as to the route by which farm owners acquired their holdings are an inadequate and technically questionable basis for conclusions concerning the eighties and nineties. However revealing this type of inquiry may be of present farm-ownership patterns, the findings can not be transferred back to an earlier period; the conditions of twentieth-century agriculture differed too greatly from those of previous decades. To suggest one possible approach to the problem, there is no study to indicate how many of the immigrant families who settled on the land in the eighties purchased farms from savings brought with them from abroad or stored up during previous periods of employment in the cities. Statistics indicating a substantial increase in the total number of farm owners, in themselves, prove nothing.

Agricultural economists have made extensive use of the data reported by farm owners as to their previous experience as tenants.[40] From this material some drew the conclusion that the step from tenancy to ownership was quicker and easier in the earlier decades than after the turn of the century. These data, like the age figures, are selective and distorted because they are based solely upon the experience of those tenants who succeeded in becoming owners. Further, they are vitiated by the factor of mortality; that is to say, the records of those who in earlier decades climbed slowly to ownership were eliminated in undue proportion because they had died by the time the surveys were made. This factor of error was early and vigorously pointed out;[41] and by the thirties prospective investigators of the agricultural ladder were being warned that distortions due to death or to departure for other occupations had not been satisfactorily eliminated from this type of data and that the earlier assumptions as to contemporary trends had not been proved.[42] Nevertheless, the fact needs emphasis that conclusions drawn from these inquiries into the working of the agricultural ladder are as invalid in interpreting the past as in interpreting the present. Moreover, these statistics of farm experience together with those on the

[37] "Farm Tenantry in the United States," 323.

[38] Goldenweiser and Truesdell, "Farm Tenancy," 83–101; John D. Black and R. H. Allen, "The Growth of Farm Tenancy in the United States," *Quarterly Journal of Economics*, 51:400(1937).

[39] Wisconsin Bureau of Labor and Industrial Statistics, *Biennial Report*, 1895–96, p. 67–85, 108.

[40] For examples, see Spillman, "The Agricultural Ladder,"; and Goldenweiser and Truesdell, "Farm Tenancy."

[41] L. C. Gray, and others, "Farm Ownership and Tenancy," 560–561; George H. Von Tungeln, "Some observations on the so-called Agricultural Ladder," *Journal of Farm Economics*, 9:94–106(1927).

[42] Black, "Research in Agricultural Land Tenure," 7; Black and Allen, "Growth of Farm Tenancy," 407.

age of owners and tenants have been the chief evidence offered by the formulators of the ladder hypothesis.

Implicit in the theory of the agricultural ladder is the assumption—indeed it is often clearly stated as a fact—that the tenant enjoyed the same social status as the farm owner. The democratic equalitarian nature of the process has often been pointed to as adequate reassurance for those troubled by the tenancy statistics. Yet suggestive of other and contradictory implications is the fact that farm wage labor and farm tenancy have so generally been regarded as transitional and as necessarily inferior to farm ownership. Even in small farm communities with relative equalities may not this attitude have resulted in subtle social distinctions between renters and owners? The tendency to attribute permanent tenancy to lack of ability or to lack of ambition warrants suspicion that in respect to tenants in the older age group such distinctions were not always subtle.

There is evidence to indicate that immigrant folk who struggled to obtain farm ownership in the eighties and nineties were not always accepted on terms of equality by their neighbors. Foreign-born farmers in the North Atlantic states—Poles, Italians, and Portuguese—frequently made the climb to land ownership by means of a standard of living conspicuously lower than that of their neighbors. A New Jersey farmer in 1888 described the process. "After years of working by the month and day and saving one or two hundred dollars they rented or bought a low priced farm, a team, some stock, and a few implements, and then commenced in earnest to get up in the world. Father, mother and children are working hard, early and late; spend little or nothing for luxuries, clothing, churches, schools, or public improvements. Whenever an opportunity is afforded they work out by the day; every dollar that can be saved goes towards paying off the mortgage on the place, or adding to the bank account."[43] Even from the Midwest came reports which suggest a similar method of advance. State officials in Ohio, Illinois, Michigan, and Nebraska were agreed in attributing the greater success of foreign-born farmers, particularly Germans, not to superiority in their methods of cultivating the land, but to their manner of living. These newcomers were described as thrifty and economical, willing to begin at the bottom while the Yankee was not; and "As a general thing their standard of living is lower than that of the American."[44] It would be interesting to try to discover whether a similarly inferior class status was attached in the earlier years of the period to immigrants who came to the more settled lands of the Midwest. At least in respect to farm laborers there was a tendency in the seventies to distinguish between the native and foreign born.[45] Furthermore, the remarks of the New Jersey farmer quoted above bring into view a broader consideration—the likelihood that an inferior economic and social status tagged even some of the hard-working folk who acquired farm ownership.

Certainly, the foregoing considerations weighed collectively raise doubts as to the validity of the ladder hypothesis. However, this paper is not meant to be a springboard for further inquiry and controversy concerning the working of the agricultural ladder. It has attacked the thesis in order to clear the way for new roads of inquiry. No constructive purpose would be served by searching the records for those who made their way upward and those who did not. The important historical fact is not that certain individuals, even though a numerous group, could and did change their status from that of tenant to owner, but that the institution of tenancy itself was growing. Consider the state of understanding of industrial labor if the recorders of its history had been concerned primarily with showing that many wage earners had become employers and captains of industry. In other words, the impetus for this discussion has been a conviction that the ladder concept is a sterile one. It has not promoted historical research. It has stifled curiosity concerning the conditions that surrounded tenancy. It has tended to exalt farm ownership as the prized goal, the pot of gold at the rainbow's end, irrespective of whether ownership brought any real advantage to the operating farmer, irrespective of the precariousness of the owner's economic status or the circumscription of his way of life.

Future historical work will benefit if students are aware of the pervasive and subtle hold of the

[43] New Jersey Board of Agriculture, *Annual Report*, 1888–89, p. 599.

[44] U. S. Industrial Commission on Immigration, *Report*, 15:528, 530, 531, 547. (Washington, D. C., 1901).

[45] Ohio Bureau of Labor Statistics, *Annual Report*, 1879, p. 255–257.

ladder concept. A definite effort is being made by agricultural economists to put aside the emotional colorings wrapped about ownership and tenancy. Historians can assist this healthy departure. They can turn a more searching light upon tenancy in the past; they can scrutinize the effect upon historical events and relationships of the American ideal of land ownership and the American faith in its attainability. There is need for more knowledge of the historical facts of tenancy—its origin, the divergent patterns of its development (or disappearance) in various sections of the country and in differing areas within the sections, its interrelationship with land policies, speculation, farm prices, land values, credit facilities, sizes of farm, types of crop, conditions of inheritance, and the attitudes of immigrant folk toward the land. There is need to know more about the manner of life of farm tenants, particularly of those who remained renters in their forties and fifties. Such inquiries will be of the greatest possible value only if those who undertake them are on guard against an unconscious acceptance of the ladder theory and all that it implies.

SELENIUM *VERSUS* GENERAL CUSTER

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Back in the nineties Ed Alderson was probably the most expert and efficient horse packer in Montana. That had been his job all his adult life. With him packing was a profession in which he took great pride. Since 1870 he had led pack trains through South Dakota, Nebraska, Wyoming, and Montana. Horses and mules were his daily study. He knew their whims, their tricks, and their troubles. He was responsible for the condition of the pack train and especially the horses. Saddle galls, lameness, colic, forage poisoning, and hoof ailments received his immediate attention. Packing and bear hunting kept Ed busy the year round. He was a free lance in both occupations, a foot-loose, mountain-roving bachelor, characteristic of those days.

Alderson was in his middle fifties when I knew him at Bozeman, Montana. On a three-months' trip in 1897 by pack train from the Spanish Peaks at the edge of the Gallatin Valley to the Hoodoos of Wyoming and return he was my packer. Knowing that he and Jack Bean had been packers for Major Marcus A. Reno's troops connected with the General George A. Custer expedition against the Indians on the Little Big Horn River, I tried to tease him a bit about their poor performance on that tragic battlefield of June 25, 1876. He came back at me with a spirited defense. The trouble was with the horses and mules, he explained. Many of them were almost useless. All of them were lame, or had sore feet, or behaved crazily like locoed animals. Some of them staggered and died a few days later. The whole pack train was slow, making about 10 miles a day instead of the expected 30 miles. The cause of the lameness and other ailments was a mystery to Alderson.

This story made a lasting impression on me, partly because, being interested in western explorations and Indian fighting, I had read both sides of the bitter controversy over placing the blame for the massacre on the Little Big Horn. I could not doubt the truth or accuracy of Alderson's observations. His frank testimony threw a new light on the matter and would tend at least to mitigate the obloquy which had been attached to Reno ever since he was court-martialed and dismissed from the service for cowardice.

For nearly a century horses and other livestock in that part of the West have often been affected with what, until a few years ago, was called alkali disease or blind staggers. The trouble was commonly attributed to drinking alkaline water. As early as 1856 T. C. Madison had described the disease as occurring in cavalry horses at Fort Randall, Nebraska Territory. The hair of the mane and tail of affected horses fell out, and the hoofs came loose, followed by a staggering gait and death after a month or two. In 1921 C. C. Lipp reported the trouble in South Dakota, especially in the counties that lay along the Missouri River, but also throughout central and southwestern South Dakota, northern Nebraska, and eastern Wyoming. Steers were so badly affected that they kneeled in grazing to ease their sore feet.

Finally a systematic study of the problem was undertaken by the South Dakota Agricultural Experiment Station and the United States Department of Agriculture. In 1931 Henry G. Knight, then head of the Bureau of Chemistry and Soils,

suggested that selenium, absorbed from the soil by plants growing on certain areas, might be the culprit. That proved to be a clever guess and led to a brilliant solution of the problem. Selenium was found to occur in soils formed from cretaceous shales from South Dakota to Mexico. Not all plants absorbed selenium in equal proportions. Legumes, especially *Astragalus bisulcatus*, and also wild woody aster, gum weed, and ground cherry were found to have a high selenium content, while grasses took up relatively less. The difference in the affinity of various plants for selenium proved to be very great. For example, when growing side by side, *Astragalus bisulcatus* absorbed 140 times as much selenium as its sister species, *missourienses*. Outside the selenium belt, however, the *bisulcatus* is a useful forage plant, being known to the stockmen of central and western Montana as wild esparcet. It blossoms in May and June. Horses, cattle, and sheep seem to like it as well as alfalfa or clover. In many localities it yields a fair crop of hay. When in full bloom, the plant is quite striking on account of the profusion of bright violet-colored flowers. Horses are most likely to eat it if given an opportunity.

During the winter and spring before the Custer battle, Reno's troops were stationed in South Dakota within the seleniferous soil area. Plants growing at the post where he was stationed showed a high selenium content when analyzed during the recent investigation. Reno reported such a shortage of the usual army hay that the horses were turned out to graze on the native vegetation. On the way from the winter station to the Little Big Horn, Reno's horses could have grazed every day on *Astragalus bisulcatus* and other plants containing selenium. No horse could have failed to see *Astragalus*. Under favorable conditions it reaches a height of 2 feet or more. The march to join Custer was made during the most succulent and palatable stage of the native flora of the Great Plains.

The circumstantial evidence connecting selenium as at least a contributory cause of the lamented tragedy of June 25, 1876 is highly convincing. Alderson's testimony that the horses of Reno's troops were affected with precisely the same symptoms as reported from several seleniferous areas in South Dakota, Nebraska, and Wyoming and as produced in experimental feeding tests during recent research, fits perfectly into the conclusions derived from scientific investigations. Sitting Bull's horses came from outside the selenium belt and were fresh and rested. Reno's horses were jaded and suffering from selenium poisoning. The outcome of the battle might have been different but for selenium.

SPACE AND HISTORY

Reflections on the Closed-Space Doctrines of Turner and Mackinder and the Challenge of Those Ideas by the Air Age

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PART 2

THE AIR AGE

The Nature of the Air Age

Thus far in this discussion, the term Columbian world has been used in the geographical sense of Mackinder and of those who have thought of geographical discovery as opening, and geographical closed space as terminating, the period usually called modern history. Although a convenient and expressive term, it is a misnomer and misleading unless more broadly defined. Social causation is the product of many interacting factors, not of one or two determinants. This Columbian world was more than an age of discovery—more than the physical movement of persons and commodities. With the Crusades (1096–1270), Western Europe was on the move, and they like all travel, were educational, contributing to the enlargement of outlook and to the blending of Classical, Arabian, and Christian thought. The perfecting of printing and paper-making after 1450 provided the means of recording, preserving, and transmitting ideas. From printing, from paper, and from a new phase in the art of building and sailing ships, the amazing intellectual activity of the thirteenth to the fifteenth centuries found a more adequate medium of expression and mobility. All of this was a preface to the age of discovery,[18] and exposes the underlying weakness of all schools of geographical determinism.

The air age is a new world opening to man through the medium of air communications—radio, television, and aircraft. In addition, as in the background of the Columbian world, the air age had its new and revolutionary mediums for recording and reproducing intelligence; woodpulp paper, the linotype, and photography; cheap mass production of newspapers, books, and pictures. All this provides a new form of mobility to ideas and to things. In a sense, it reopens space. It is different, but flight is probably as significant to this age as the early period of discovery which is said to have opened the Columbian world some four hundred years ago. The air age must be thought of as more than the age of flight, however, because flight, like discovery, is only one form of mobility. The air-age trilogy is sound, sight, and flight, and all three are derived from science. Space alone has no significance. Space consciousness is created by the coordinate factor of movement—it is mobility in space that gives it meaning. The surface space of the globe had existed always and the fact was known to the Greek philosophers, but it was the discoveries of the Portuguese and Columbus in conjunction with printing and sailing ships in the fifteen century which gave it meaning by utilizing it. Until the second quarter of the twentieth century, space was two dimensional. Air space had existed always, but it was only as air communications introduced a three-dimensional era that the fact of air space began to take on meaning. The form the air age will take lies with the future. The place of the individual in that world has yet to be defined on the basis of experience.

One of the characteristics of the Columbian world was hope on the part of the individual, in contrast with the defeatism and other-worldliness of the Medieval system. New facilities released new potentials for individual expression in terms of positive action, or mobility, and psychologically there is a close relationship between mobility and hope. The new age was individualistic, nonconformist, and creative, and possessed an urge to express itself in its own idiom. It was the expression of this new age in America, in a peculiarly favorable

[18] Contemporaries of Prince Henry the Navigator and Columbus in the fifteenth century were Erasmus, Machiavelli, Ghiberti, and Leonardo da Vinci. The sixteenth century produced Zwingli, Calvin, Luther, Shakespeare, Cervantes, Francis Bacon, Copernicus, Michelangelo, and Palestrina. The seventeenth century continued the tradition of originality in Descartes, Hobbes, Spinoza, Leibnitz, Newton, Rembrandt, and Milton.

geographical setting, that misled the Turner nationalist school of history into crediting these characteristics to the influence of the frontier, when, in fact, they were only the highly significant American variant of the Columbian world.

The air age opens again a new world of possibilities, and some revival of hope after nearly a half century under the shadow of the idea of two-dimensional closed space. The element of hope is only one aspect of the situation, however, taking root slowly, and it must be tempered by some scepticism concerning the use man may make of the new opportunities and the power that science and machines place at his disposal. Power machines have produced so remarkable an acceleration in the rate of change that a totally new relationship has been introduced among the three historical factors of time, space, and movement. Time has been a saving factor in history heretofore, not only to the single generation of individuals, but to the overall adjustment of man to change. Shakespeare said that sleep knits up the raveled sleeve of care, and time has served a similar historical function when man's faculty for adjustment failed him. By the opening of the Columbian world, the time factor was not much altered, except in relation to the dissemination of intelligence through the printed word. Sailing ships and geographical discovery enlarged the range of mobility in space more than they accelerated the speed of movement within the formerly utilized space. It was the increased range of mobility that so largely gave character to the Columbian world, and that fact is spotlighted by the emphasis placed upon geographical discovery—the name Columbian world is itself evidence. Possibly this traditional stress upon discovery rather than upon intellectual activity translated into mobility of communications through the medium of the printed word has gone too far and needs to be redressed, but in any case range of mobility constitutes a major significant difference in contrast with the Medieval world. In this mechanical-powered age, particularly the air-age emerging from the shadow of the idea of closed space, acceleration in speed of communications is the most impressive characteristic. The directions and routes of intercourse within the known globe are undergoing drastic changes, but it is all within the world already made known by the Columbian discoveries. Some expansion of range is present, of course, in the sense of more effective utilization of available space, but speed and flexibility of air communications must compensate for the absence of new surface space in the calculations concerning the social order of the coming age. It has within it the possibilities but not necessarily the assurance of opportunity. If such an idea of the compensatory function is invalid in theory or breaks down in practice then indeed man is faced with a future of closed space. In the air age, man's inventive ingenuity in making machines has given him a phenomenal new power potential but has foreshortened the time factor and thereby deprived him of his most valuable insurance against disaster from his own acts, both of commission and omission. Most of this occurred in the transitional century from about 1840 to 1940, when mechanical power was effectively applied to movement through space for the first time. Primarily utilized for the movement of persons and intelligence in the form of steamboats, locomotives, and the electric telegraph power was applied to ocean carriage of bulk commodities after 1875. The dislocations resulting from this brief experience with mechanical-powered mobility in a two-dimensional world would seem to justify the reservations expressed with respect to a three-dimensional air age. Man has so little experience with such dangerous playthings.

Two of the most insistent facts of American history are space and mobility. Their psychological effect upon the American has been too much ignored at home, but probably the most lasting impressions which a tour of America makes upon European students are the magnificent distances and the extent to which Americans travel. Mackinder's essay of 1904 on the geographical pivot of history, or his book of 1919, *Reality and Democratic Ideals*, could not have been written by an American. Turner had recorded what he interpreted as the passing of the frontier, concluded that it closed an era in American history, and suggested that the new era without the frontier would be different; but neither he nor the school of historians who followed his leadership had any insistent sense of the reality of the new era. In fact, the frontier, even in the Turner sense, had not passed in 1890 and really did not pass until shortly before World War I. Not until the 1930s and the depression of that decade did Americans become acutely aware of closed space in anything like the European sense, and then without the perspective and poise which the centuries had built into the older civilizations. The frustration of the generation between the two world wars reached its climax in the defeatism of regimentation by the New Deal.

There was little constructive analysis and interpretation in terms of the new factors which had shaped largely the twentieth century. Except for some leaders in the air industry, and a few others, American civilian leadership was looking down and inward, not upward and outward into air space and new opportunity. Commercial aviation was made the football of partisan politics. Military defense was still dominated by the ideas of Mahan. Mitchell was virtually dismissed from the army during the 1920s, and not until the second year of World War II was the fact of air power given an approximate recognition by the United States Government.

At the opening of the Columbian world, the first reaction of governments to the new discoveries was to seize a monopoly of the most obvious evidences of physical power. Likewise, in the first stages of the air age a ruthless scramble is under way for a monopoly of the newly accessible space and for the more apparent symbols of power. In neither age, at the outset, was there much concern over the inner significance of change. In pursuing the voyages of discovery southward along the African coast, Portugal sought and received (1452, 1454, and 1481) from the Pope, the pretender to world authority, a monopoly of all new space. The Columbian discovery under the sponsorship of Spain challenged the Portuguese monopoly, and the Papal Bulls of Donation (1493, 1506), modified by the parties concerned in treaties of 1494 and 1529, divided the New World between them. In 1580, Spain absorbed Portugal and held all the power of both. The Dutch revolt began in 1568, and in 1580 the attack was extended to the Portuguese colonies. The rise of English sea power during the sixteenth century defeated the Spanish Armada in 1588 and broke the prestige but not the sea power of Spain. The struggle for the redistribution of power was continuous.

The twentieth century had a world authority in the form of the League of Nations which miscalculated the air age. It did not grant the air-space monopoly intentionally but inadvertently permitted Germany to seize the first advantage. World War II is the second phase in the struggle for air dominance.

Island Empires in the Air Age

Under the influence of a theory of air power and the land-mass approach to geopolitics, there has been a tendency to count out the British and Japanese empires based upon islands and sea power. Historically, the island position of Great Britain, just off the European peninsula, had been her greatest strategic factor of safety when taken in conjunction with sea power. Even on the threshold of the era of air power, the events of 1939–1943 demonstrated that this geographical factor still possessed validity. The concept developed from Mackinder held that a land mass possessed undoubted strategic advantages under given circumstances through concentration of power, but the British and Japanese empires have demonstrated that, with geographical positions wisely chosen, there is also another way of buying time with space than by the size of the land mass. There is reason to doubt the assumption that the power of geographical position is held by any single area as a world monopoly. The factors of land, sea, air, resources, and people—and not the least of these is people—may be put together in several different combinations and produce enduring power. Great Britain held the advantage of coal and iron in the iron-steel age, and on this score Japan was handicapped. But in an air age, the situation changed substantially through the wider use of light metals, alloys, and plastics whose sources of supply are widely scattered, and the attitude must be to wait and watch developments. The multiple historical forces that have operated through the centuries in creating these empires may possess an uncalculated validity and vitality even in an age of air power and may be combined effectively with the newer power potentials of flight.

The North American Geographical Axis

On the threshold of the air age, the directions of development of power potentials are rapidly being redefined, and the transitional phase is well along. Under the influence of Columbian thought patterns, geography was defined as Old World and New World, and consequently as Eastern and Western hemispheres. America as a name was applied at first only to part but later to the whole of the Western Hemisphere, and more recently, the Monroe Doctrine, Pan Americanism, Hemisphere Solidarity, etc., have become the political expressions of the same idea. The air age introduces a geographical reorientation in terms of Northern and Southern hemispheres. The earth's great land masses, situated in the temperate zones and capable of supporting large populations at the highest peak of efficiency, lie mostly in the Northern Hemisphere, and the resulting community of

great states should constitute a circumpolar system. The lines of communication, which must necessarily be important determinants of power, are great circle routes traversing arctic and subarctic areas. In the long run, North America's orientation should be north, not south, or east, or west.[19]

Irrespective of an imaginary line now dividing but not really separating the United States and Canada, the heart of America lies in the great interior basin with its immense quantities and varieties of agricultural and mineral resources and power in the form of coal, gas, oil, and hydroelectricity. This continental land mass possesses size but is not so great as to be unwieldly or to invite contests for division among two or more powerful states as in Eurasia. Its size affords space depth; its mountain ranges on either side constitute substantial barriers against surface invasion by the open-sea approaches; and its river systems with no barriers between them, north, east, and south, provide surface mobility. To capitalize upon the full value of the continent, the power axis should lie in a north-south line, on the west side of the Mississippi River, extending from the Winnepeg area at the north to the Dallas-Fort Worth area at the south. This central axis should be tied in the northeast into the heavy industry and population area of the upper Ohio Valley and the Great Lakes —St. Lawrence watershed with its coal, iron, and hydroelectric power; in the southeast into the Birmingham coal and iron and the Tennessee Valley hydroelectric power areas; in the southwest into the mid-continental oil and gas and the Colorado River hydroelectric power areas; in the northwest, into the Columbia River hydroelectric power system; and north of Winnepeg, into the Mackenzie River oil field.

On the basis of the artificial political boundaries of the United States alone, the center of gravity would lie toward the southern end of the axis, possibly the Kansas City-Wichita-Salina triangle, but on a continental basis and in relation to the circumpolar system, the center should lie farther north. It would be more to the point, however, to think of a flexible system of power potential distributed along the length of the axis with the effective center shifting to fit changing requirements.[20]

In part, the surface transportation system has developed already a pattern which conforms to this plan. The transcontinental rail systems have a sort of double hinge, approximately the Mississippi and Missouri river lines. The second rail consolidation plan of the Interstate Commerce Commission (1926) was a concession to facts on this point. Thus far, both the rail and highway systems, orientated on east-west lines, fail to provide for adequate north-south mobility along the Winnepeg-Dallas axis. During the transitional period, rails and highways must continue to carry the major burden of the Nation's transportation load, especially bulk commodities. This, however, should not obscure the underlying fact that they are only adjuncts to the basic air communications system of the future. Along this central axis should lie the major commercial air centers and the mechanical facilities for servicing the air industry.

During World War II an extensive migration of industry into the interior has taken place, and it is reasonable to believe that this was an acceleration of a trend rather than a new departure. A relatively rapid shift seems to be in the making from the heavy industries, based directly upon coal and steel, to the lighter industries based upon lightweight metals and alloys, plastics, and the flexibility of electrical power. A population redistribution must accompany such a shift in economic organization. The diversity of sources of lightweight metals tends to break the monopoly of the Pittsburgh-Great Lakes area on fuel and raw materials. Furthermore, the source of raw materials for plastics is the agricultural interior. The flexibility of electrical power and fuel from the mid-

[19] This statement does not ignore or preclude the important geographical fact that the exploitation of the tropics by the machine age began only in the final quarter of the nineteenth century and thus far has made only a preliminary sampling of tropical possibilities. So far as present knowledge and technology have gone, the prospect remains that the tropics will continue dependent on the temperate zones although contributing largely to the world system.

[20] Basing his system of military defense on the United States alone, Alexander P. De Seversky in *Victory through Air Power* (New York, 1942), placed his center of power in Kansas, the geographical center of the country. See the diagrammic map on "Air-Force Control," p. 309. In another diagrammic map, "Air Control of the World from the United States," p. 315–316, he designated four base points—Alaska, Maine, Florida, and San Francisco—with the "Command Air Force" in the center. In the Walt Disney film version (1943), Seversky modified this, but leaving his center of power within the United States, carried his lines of flight across Canada.

continental oil and gas fields tends to neutralize the relative absence of coal in the area between the Mississippi River and the Rocky Mountains. If such an analysis is even approximately correct, the change must effect a major revolution in American agriculture. The population will be moving toward the major source of food supply instead of away from it as formerly. The advantage of foreign sources carried by cheap sea-born transportation would be partly neutralized by shortened land supply lines. On the other hand, production costs would advance with higher land prices under the influence of greater densities of population. The importance of nearby sources of hard bread wheat and meat would cause a comprehensive revaluation of the significance of the Great Plains in American history.

The great central agricultural area of the continent may undergo rapid urbanization, a process not to be identified necessarily with industrial cities and density of population but with utilization of the facilities of the great public utilities and of organized communities for educational and social as well as business ends. A way of life may emerge in which the segregation of agriculture as a business from labor and from the home will be conspicuous, as well as the use of capital and farm wage labor in the cultivation of land and the raising of livestock. The relative position of the traditional family-owned-and-operated farm must continue to diminish in importance. When governmental controls over land have reached the present degree and further extension seems probable, it makes less and less difference who holds the title. Except in the transitional stage the historical controversies over private landownership and tenantry must be of lesser relative importance, as the struggle for power to exercise the controls becomes more significant. Regardless of what may be said in political campaigns there can be little prospect of a rollback to the nineteenth century rural independence.

Military Defense

The primary defense system of North America should be organized on a quarter-sphere basis, the continent with a secondary outlying line of defense to be used in a passive role. The fullest realization of this would call for a union of Canada and the United States, admitting the Canadian provinces into the Union as states. Short of outright union, the next best procedure would be an *entente cordiale*, and if not *cordiale*, at least an *entente* with military collaboration. Anything short of this minimum might be fatal to both Canada and the United States. The primary organization of defense should be air power based upon the north-south interior axis with an aerial power potential of sufficient efficiency and range to strike an enemy on a global scale. The number of units would be less important than the efficiency of the machines, organization, and personnel. The servicing of a naval fleet to maintain command of the sea depended upon bases in all possible theaters of operations and the maintenance of lines of communications. The servicing of command of the air depends upon home bases and sufficient long-range flying equipment for distant operations. Although important in their place, sea and land power are now reduced to the status of auxiliary services and always should be subordinate in strategical calculations to air power, the first determinant of military might. The giant battleship was the final expression of the dying Columbian age (1890–1940?), the period in which the idea of closed space was dominant; and had not air power sunk the steel battleship, it would have sunk itself through sheer giganticism, much as the mounted knight loaded himself with armor until he became helpless and useless. The battleship was in need of the services of a Cervantes. Thus far the United States has never been called upon to fight a modern war in defense of her own soil or even in defense of the Western Hemisphere. The next war may be that kind of conflict. No great nation has ever escaped indefinitely such an ordeal.

Foreign Policy

In a circumpolar system, there is room for seven or more major powers: From east to west—North America, Japan, China, Russia, Germany, a possible Latin union of Western Europe, and the British Empire. The hates that have driven peoples to war should not blind the post-war world to the power of historic forces. The world cannot escape history. Statesmen do not hate because hate impairs judgment.[21] Germany and Japan will have their place in the post-war world, if not with the consent of the United Nations, then without it. If Germany and Japan are destroyed by the war, it would be to the interest of the United Nations to reconstruct them. With respect to

[21] Hoffman Nickerson, *The Armed Horde, 1793–1939: A Study of the Rise, Survival and Decline of the Mass Army*(New York, 1940).

Russia, likewise, historic forces are determinants. The interests of a major state are fundamentally constant, and, except for detail, are independent of the form or the personnel of government. Any violation of such a rule would be only a temporary aberration. Russia is the same in her primary characteristics, whether ruled by a Tsar or a Soviet dictator, and remains Asiatic, with only a minor admixture of the Western European spirit of civilization.

The desire for overseas airbases under the control of the United States but outside of the continental system is an element transferred to the air age from Mahan's sea age. It is attractive also as a matter of national pride and prestige. Such bases would be considered a threat, however, in any overseas region in which they might lie and as such would constitute needless points of contact and friction. They become a commitment in a region outside the true American sphere, without providing the air power potential necessary to meet the corresponding responsibilities. Such bases are interpreted as essentially aggressive rather than defensive. The United States is not a sea-power nation from force of geographical location as are Great Britain and Japan. A land-mass state, the basis of its interest is the North American continent, and power should not be dissipated by scattering holdings with their corresponding commitments. As a matter of policy there should be a withdrawal from the Western Pacific and Eastern Asia, except as a matter of participation in collective security through some form of regional and world organization. By the same token, new commitments should not be made south of the Amazon basin, or across the Atlantic in Africa or Europe, except again, by participation in collective action. The United States should be bound by the same principles with respect to areas outside America that she imposes upon the great powers with respect to America.

International Organization

There can be little disagreement on the general proposition that there must be some form of international organization after World War II. On the particular form of such an organization, there must be the widest divergence of opinion, and its extent should not be minimized. Experience with the League of Nations should contribute a few principles. Among them are a more effective means of balancing the interests of the small and large states and a recognition of a division of powers between regional concerts of nations and the overhead world machinery.[22] If the power to coerce a state is provided, it should be hedged with substantial safeguards against abuse. The safer procedure would be to omit force.

If there is any value in the example of the United States as illustrating the federative principle in history, it is important to recognize that those parts of the Constitution which worked most successfully were those chosen most carefully from the established practices in colonial history. The United States is conspicuously a product of history. Beginning with independent sovereign states, cooperation in the Continental Congress gave way to the Articles of Confederation, and they in turn to the Constitution. Each successive step incorporated a more complete adjustment of working principles, but the Constitution had not yet solved all outstanding differences. In fact, one of the most important contributions made by the Constitutional Convention of 1787 was what it did not do. The Fathers of the Constitution showed the good sense to evade and postpone irreconcilable issues such as state and national sovereignty in the hope that time would dissolve the differences. No mention was made of power to coerce a state. After seventy-five years of experience and debate, time had not solved the issues of sovereignty and coercion, but time had built into the union of states a loyalty to the principle of union which stood the test of four years of civil war. It took a war from 1861–1865 to settle the issue in favor of union, a war which, in 1787, would have destroyed all hopes of union.

The world stage is far more complicated; historical processes require time; and the measure of statesmanship lies in the exercise of judicious re-

[22] A number of discussions of world organization deal in one way or another with the problem of regionalism See the memorandum prepared for Woodrow Wilson in November 1918 by Frederick Jackson Turner, "International Political Parties in a Durable League of Nations," edited by William Diamond under the title "American Sectionalism and World Organization," *American Historical Review*, 47:545–551(1942). See also Alfred Zimmern, *The League of Nations and the Rule of Law, 1918–1935*(London, 1936); N. J. Spykman, *America's Strategy in World Politics: The United States and the Balance of Power*(New York, 1942); and Pitman B. Potter, "Universalism versus Regionalism in International Organization," *American Political Science Review*, 37:850–862(October 1943).

straint in not doing too much too fast. It may be that several constitutions for the world will succeed each other. It is probable that wars will be fought. Finally, the United States is peculiarly concerned with the issue of the use of force, because, as the great creditor state, there is every probability that the debtor combinations will be united against American financial domination. As a land-mass state, without a powerful rival in the hemisphere, the United States has been isolationist and for some time must remain relatively so in spite of the coming air age and the obligations to cooperate in a world society. After another seventy-five years, or a time comparable in world history to the period of 1787–1861, the appropriateness of the power to coerce may be illuminated by experience and by the natural realignment of loyalties.

Democracy

In general, social institutions respond relatively slowly to change, and this fact is accentuated by the acceleration imparted to the tempo of living by the air age and machine culture. The ideology of democratic government is largely that of the nineteenth century which permitted a leisurely process of government by active popular participation, especially as expressed in universal suffrage, the application of the equalitarian principle to office holding, and lawmaking by the people's representatives. The stress was upon the legislative function, not the executive, and the latter merely enforced the laws, particularly in the punitive sense of punishing violations. The Articles of Confederation had dispensed with the executive altogether, but the Constitution restored the power, although with some show of misgivings. The twentieth-century progressive movement admitted defects in the performance of democracy and as a remedy advocated more democracy to supplement and reinforce the existing representative institutions by the addition of instruments of direct democracy and more effective means for assuring responsibility of all agencies to popular opinion.[23] Most of these proposals related to the process of legislation. In this movement to strengthen government and its control over society, expression was given pointedly to a distrust of the traditional executive. A new type of executive was given extensive trial in the form of commission government, which was an attempt to apply administrative methods to the democratic process. The important point is that faith in the democratic principle was still complete.

Between the two world wars, the situation changed, and popular participation in government declined. The passing of the Progressive movement left in its wake a doubt of democracy. More and more the executive assumed power, and a strong impetus was given to government by administration rather than by legislation. This form of government became the American version of the world-wide totalitarian tendency. The administrative approach to government took shape gradually but reached its climax in executive hands in the Roosevelt New Deal period.[24] The Congress enacts only generalities, and the executive branch, through its administrative agencies, enacts the substance of the law by the devices of administrative directives and decisions and then executes them. This violates one of the historic principles of popular government that the authority that executes the law should not make it and demonstrates anew the validity of that principle by the exhibition of a steadily increasing executive disregard for the general laws printed in the statute books and for the traditional and legal rights of the individual. Arguments in justification of such government by administration stressed the necessity of quick decisions, the use of experts, and the importance of efficiency in this complicated machine-age society—Mackinder's Going Concern.

Between the equalitarian democracy of the second quarter of the nineteenth century and the administrative totalitarianism of the Roosevelt era lay a long transitional process. Civil service reform of the third quarter of the nineteenth century was conducted in the spirit of a moral crusade, attacking the inefficiency, waste, and corruption of the spoils system, which had become one of the conspicuous weaknesses of equalitarianism. Merit became the watchword. It was done in the name of democracy and not as an attack on democracy, but it struck at the heart of the equalitarian principle by establishing the competitive principle—an admission that men are not equal. It set up a

[23] Ralph Henry Gabriel, *The Course of American Democratic Thought: An Intellectual History since 1865* (New York, 1940). This brilliant book presents democracy as "the philosophy of the mean."

[24] "What's to Become of Us?" *Fortune* 8(6):24–26, 28–30, 112, 114, 117, 118, 120(December 1933). The important portion is the analysis of F. D. Roosevelt's personality on pages 28–30.

new kind of aristocracy—a governmental group theoretically based on quality. In theory also, government by the best, if carried out to its logical conclusion, meant dictatorship, because there could be only one best. Such a line of reasoning exposes the fact, however, that any theory applied to social phenomena and carried out to its bitter-end conclusion only tends to become absurd.

Commission government as the democratic approach to the problem of administration was first associated conspicuously with the Interstate Commerce Commission of 1887, but the Progressive movement of the early twentieth century gave this institution its particular blessing. The objectives were bipartisan appointments, long terms to remove it from the political vicissitudes of elections and overturns of political parties, decisions arrived at in a judicial spirit based upon investigation of facts, and a meeting of several minds rather than the whim of one person. In short, it was intended to meet the democratic ideal of government by law rather than government by men. The commissions were suspended between the executive and legislative departments and supposedly were independent of both. After World War I, the executive challenged these independent commissions. Coolidge and Hoover proposed either that they be abolished or that their policy-making and administrative functions be transferred to the executive departments. Neither of these presidents forced the issue, but with the inauguration of Franklin D. Roosevelt hesitancy disappeared, and all have been abolished or brought into subserviency to the executive. The political theorists of the New Deal, in rationalizing the outcome, denied even the validity of the ideal of government by law, holding that all government was by men—personal government.[25] To admit such a conclusion was to cut off the very tap root of democracy as a principle of government.

The Constitution of the United States had set up a system of three independent departments, each with checks upon the others. For the first century and a half, the upsetting of the balance from time to time had been redressed in due course, but the culmination of the administrative principle under the Roosevelt regime subverted the historic system. Even if the accumulation of miscellaneous resentments should overthrow Roosevelt, the new incumbents would almost certainly attempt to entrench themselves in power by similar means. The administrative type of government possesses a tactical advantage of a monopoly of essential information in the hands of its agencies. Numerous instances have occurred of executive spokesmen ridiculing opposition critics for lack of accurate or adequate information. Frequently this was justified, but too often the executive could and did possess and maintain a monopoly on all information essential to a sound debate on the public policies at issue. Such a situation threatens the very existence of an effective two-party system. Without essential information, opposition tends to lose an organized character and becomes a multitude of frustrated factions, each with an accumulation of resentments.

The administrative era was characteristic of the period which placed a peculiar value on what was called organized efficiency rather than on the creative spirit. The administrative mind does not necessarily represent great ability, but organization means power and there was a tendency to place an exaggerated value upon such services to society and to convince the public of it. The creative mind and the administrative mind are both essential to society, each in his own way. The creative mind is the more rare, and that fact should emphasize the importance of redressing the standards of measurement by which society sets the values.

In the American system of legislation by compromise, the form of the statute is often ambiguous, both in language and in policy. The Supreme Court becomes the scapegoat for the differences of opinion upon which the Congress, or the executive and the Congress were unable to agree. Most conspicuously this is true when new departures in legislation are enacted under any form of compulsion. In connection with important cases, the condemnation of the court by the losing side diverts attention from the real issue. A more com-

[25] By 1944 the conflict among the F. D. Roosevelt appointees to the Supreme Court had become a matter of public record. Associate Justices Frankfurter and Roberts joined in a dissenting opinion which condemned "the tendency to disregard precedents" in Supreme Court decisions on the ground that "the law becomes not a chart to govern conduct, but a game of chance; instead of settling rights and liabilities it unsettles them." They said further that "the more deplorable consequence will inevitably be that the administration of justice will fall into disrepute. Respect for tribunals must fall when the bar and the public come to understand that nothing that has been said in prior adjudication has force in a current controversy." Associated Press report of the opinion, Feb. 2, 1944.

plete observance of the democratic process of full debate and making haste slowly by the procedure of growing into policies would afford a sounder course of action and avoid the demagoguery associated with the primitive custom of loading the failures of society upon the scapegoat.[26]

If the balance between popular government and the executive is to be maintained in a machine age, some modifications are necessary in the historic structure of American institutions, but they should be changes that are rooted in the American scene rather than foreign ideas engrafted upon it. The emphasis upon the administrative function in government is one of the necessities, but at the same time a comparable insistence must be made upon safeguards to the individual. The English common law principle that the presumption of right lies with the individual and the burden of proof of an overriding public interest is against the government must be preserved. Some form of judicial review of all administrative action is imperative as a safeguard. Such procedure requires presentation of facts and reasons, cross-examination and independent judgment of public necessity, and some flexibility in application to individual and sectional differences. The right of redress must be within the reach of all, because a right which exists only in theory and cannot be exercised effectively in practice is no right at all.

Not only has the balance of power between the legislative and executive branches of government been upset, but the rise of organized pressure groups as a fourth branch of government challenges the adequacy of the existing system. The American plan of representative government had its origin in the practice of identifying the representative with a geographical area. In theory, the citizen still asks his geographical representative to act for him in Congress, but in fact an organization often acts for him, either with or without his consent. The pressure groups have come to stand as a form of economic or social group approach to representation. Their position has not been defined by law and rests solely on practice. It is time that the experience is translated into law with respect both to the relations of such groups to the constitutional machinery of government and to the individual citizens, whether members or not, whom they claim to represent. As a beginning there should be an accounting to the public of their finances, methods of determining the wishes of members and membership, and the extent to which it is representative of the group for whom they profess to speak. The point is that in few cases, whether in business, labor, farmer, medical, teacher, or clerical groups, are the individual members consulted by their spokesman. Under whatever disguise the decisions are made, the membership is whipped into line and then made to appear to endorse them, or possibly there is no pretense of a referendum. These organizations came into existence to meet a need, but being relatively new as institutions they require substantial internal reform to perfect their spirit of responsibility both to the group and to society. There is another alternative, however; with adequate revision of the regular system of representation and elections pressure politics as now practiced might possibly be eliminated.

American presidential elections present unusual difficulties to the practice of democracy in terms of personalities, issues, and the problems of suffrage. The several issues appeal differently to the independent voter who is the determining factor in elections, but when conflicting issues and contradictory policies are combined into each of the platforms of the major parties to conciliate factions, they tend to cancel each other and reduce the voters to uncertainty. This is further complicated by the factor of candidate personality, because the voter frequently finds that the appeal of personality is opposite to the appeal of the issues or turns the balance when platforms are particularly indefinite or contradictory. All this is further confused by sectional, class, religious, and race differences. The immense numbers of voters make the system unduly costly and unwieldy, especially in view of the indecisive results. National elections are seldom, therefore, if ever, mandates from the people on particular policies, but, at best, are only in the nature of an over-all expression of the participating voters on the general situation and at their worst tend to discredit democracy as a way of life.

The decline of participation in government on the part of eligible voters was conspicuous between the two world wars and reflected a widespread sense of futility and a loss of faith in popular government. The situation is so serious as to call for reexamination of the accepted fundamentals of democratic machinery. The development of sta-

[26] Thomas Reed Powell, "Would the Supreme Court Block a Planned Economy?" *Fortune*, 12(2)48–49, 128, 129, 130, 132, 135, 137(August 1935). Powell emphasized the importance of step by step innovation.

tistical procedures and their application to social problems suggest new approaches to the analysis of public opinion. Instead of counting every unit in a mass of data, the statistician selects samples for analysis and arrives at results fully as accurate and far more quickly and cheaply. Disregarding the historical assumptions of equalitarian social theory of the eighteenth century and its emotional content, the application of the procedure of statistical analysis of equalitarian universal suffrage practices exposes the fact that at best it is only a method of sampling. In the 1830s the definition of eligibility for voting was approximately male-white-free-21; in the twentieth century it became male-female-21. Contrary to popular ideology, that was not universal in either case, and this is emphasized by the demand for a lowering of the age to eighteen. What virtue is there in merely further enlarging the sample? In statistical analysis an adequately large sample is one that reaches a saturation point with respect to the mass of data beyond which further enlargement of the sample will not change results. Manhood suffrage of the 1830s had more than reached that point, and doubling the number of voters by woman suffrage did not change the results in spite of the naïve popular assumptions. In fact, woman suffrage rendered the sample less rather than more representative because of the far higher rate of default in exercise of the privilege. Lowering the age to eighteen cannot have any material effect on election results in the long run.

Universal suffrage as a method of sampling public opinion assumes that every individual is equally competent and that every one will participate. In practice the results are far from the ideal on both points. Not all have either the interest or the understanding. Why expect each to make his contribution to society in exactly the same manner? Why expect everyone to be equally talented in government any more than in music, medicine, mathematics, law, science, or mechanics? Much of the agitation for education of the public in citizenship and insistence upon a full vote is based upon such wholly unsound presumptions. For any method of sampling to produce sound results there must be a close correlation between eligibility and participation. A high rate of default on the part of some eligibles together with a full participation on the part of other eligibles stimulated by political machine organization or a special interest consciousness destroys the validity of the sampling process regardless of the pretense of universality of eligibility.

It is an accepted principle of political science that suffrage is a privilege and not a right. The major factor that protects the existing system from more outspoken condemnation is that it is hallowed by tradition and is supported by the powerful emotional symbol of equalitarianism. It is time for frank public experiment with sampling techniques of a new kind. Already much has been done in this direction by private initiative. They might be applied to the over-all problem of general elections, but they seem particularly applicable to the sounding of opinion as a whole on single issues or clearly defined attitudes. Using the federal census as a guide, the samples could be devised in various ways to analyse different segments of the population, and the several sections, and economic or social groups. This might change completely the relation of pressure groups to government. The facility with which sampling can be done opens the way to the charting of changes of opinion so frequently as to provide a continuous record. It is important to explore the possibilities without becoming an advocate of any particular procedure. It does not mean the abandonment of old procedures but only the addition of new ones to supplement the old until a sounder plan is evolved and established in public confidence. The foreshortening of time by the air age calls for revision of the unwieldy and indecisive machinery of tradition and the building into the institutions of democracy the means of speedier and more accurate decisions.

The final objective in democracy is always to keep the balance of control over policy in the hands of the popular branch of the government and to keep the executive branch continuously responsible to popular control. A complicated world of science and machinery, operating under the compelling necessity of arriving quickly at decisions and action, contributed to the upsetting of the balance in favor of the executive and government by administration. It made possible the Roosevelt family gibe at democracy, that the executive acts and Congress debates afterwards. If democratic processes are to function in an air age, a way must be found whereby the popular branch can function with comparable efficiency.

Several of the States have experimented since 1933 with the legislative council idea, and it has

produced significant results.[27] A form of that plan used in Kansas provides for a bipartisan legislative council made up of house and senate leaders who prepare legislation. The vital part of the council plan is a research bureau which assembles, verifies, and classifies factual information essential to the consideration of measures and policies. The success attained in the States suggests that such an American device evolved out of the political experience of the States might be adapted successfully into the framework of the Federal Government. Leadership from both houses of Congress would be unified in the council, and the research bureau might break the executive monopoly on essential information. Much research work now performed by executive departments could be transferred to this research bureau under congressional control, and the traditional congressional investigating committees could be discarded to the benefit of all. With facts prepared on the basis of research and legislation prepared by the legislative council rather than the executive, the interpretation of facts and their application to policy would then be the function of political parties, the press, and individuals through the process of public discussion. Governmental research would be no substitute, however, for independent private research—either of individuals or agencies. Any organization, governmental or private, needs the challenge of a rival having both the resources and the power to check and verify its findings. No one has a monopoly on truth, and besides, such a proposal for a governmental research agency would be more in the nature of a service than a creative organization. It might conduct experimental sampling investigations in public opinion analysis, however, and thereby break the irresponsible power of organized pressure groups. Such agencies of research and public opinion analysis, both public and private, might also serve as the means of protecting the main body of society from the excesses of extremists of both the left and the right.

The Individual

In analyzing the nature of the air age, it is necessary to go beyond the more obvious aspects which gave it the name and to undertake to evaluate it in terms that clarify the essential contrasts with the Columbian world. The most insistent difference is, of course, that man is no longer earthbound, that by means of radio, television, and flight, man can hear, see, and move through the air within the global limits of the earth's envelope. Analysis of the process of social causation is baffling, its ramifications are complex, and the implications of social change are elusive and sometimes paradoxical.

In the Medieval world, mastery or excellence lay in the training and exercise of physical skill of the individual, soldier and artisan, in the use of simple hand tools. The Columbian world came to place less relative emphasis upon physical skill and implemented the individual with power tools—firearms, sails, steam engines, and machines—but they were still tools in the hands of the workman. The air age places at his disposal automatic machines which are freeing him from the tool. In a completely automatic factory, the workman is no longer engaged in making the product. His function is to service the machine.

The Medieval was the age of the skilled artisan, the Columbian the age of the amateur (self or informally trained) who could perform wonders with his power tools, the air age is one of scientific skills acquired through formal training and based upon science. Such a singling out of separate factors tends to introduce exaggeration, but there is sufficient validity in the contrast to emphasize significant differences.

Behind all ages is the individual, the ultimate creative force in history; in his mind lies the capacity for pure thought, for dealing with abstractions, and for translating them into tangible realities for the use of others. Organization may often more effectively perfect and develop a new idea once it has been formulated, but only the individual can create. The creative mind is something apart from the matter of formal training. An important question of the future will be whether, in an age of scientific specialization, the creative mind can enjoy the opportunity for the formal training essential to its best performance. How can potential creative capacity find expression? Can it be discovered by society through the application of some form of tests, or must it unfold itself only in its own way through its own inner urge? Can a society which wastes such energy lay claim to being civilized?

The threat to the individual was not from the passing of the frontier of Turner, nor from the closed space of Mackinder, but from a machine

[27] Frederic H. Guild, "The Development of the Legislative Council Idea," American Academy of Political and Social Science, *Annals*, 195:144–150(1938).

culture and a science-skilled era which outmoded the self-trained or informally trained amateur. The application of science to attain mastery over nature and to supply human wants, as stressed by Strong, Mahan, and Crookes, was not a complete answer, and was not without its dangers to opportunity. The individual was not faced with a loss of opportunity so much as with a change which made it less accessible. Even in the Columbian world, opportunity was in many respects more an illusion than a reality, and to dispel that illusion is an important contribution to any restatement of the idea of loss of opportunity in the machine age.

The dynamic spirit of the Columbian world—movement, action, hope, and creativeness—had arrived by the end of the eighteenth century at the twin dogmas of equality and progress. A century later, the idea of the loss of opportunity is to be explained in terms of these determinants. The idea of equality was derived in part from certain Christian Protestant doctrines of equality before God and in part from the rationalist philosophy of the natural rights of man. The idea of progress was derived from an assumption, so effectively phrased by Condorcet, that each and every individual of these equal men was capable of unlimited perfectibility. Although the philosophers of the nineteenth century were generally skeptical of the natural rights of man and the ideas of the Declaration of Independence were labeled as "glittering generalities," the doctrine of equality was firmly rooted in the popular mind.[28] Even more completely, the idea of progress dominated almost all classes. Both were emotional phenomena—acts of faith rather than proven facts. A restatement of the problem of opportunity in the air age requires that both the doctrine of equality and the idea of progress be discarded.

Taken together, these twin dogmas assumed in theory the rise in status of all classes until society became classless. In practice, the mere multiplication of wants and gadgets to satisfy them became confused with rise in relative status. The twentieth-century emphasis on formal training only underlined what the nineteenth century had come to suspect, namely that there was no rise of classes in relative status, that only certain individuals rose in status, and that there was only a redistribution of status within society. A growing realization was manifested in several ways, by indirection, that there never had been and never could be opportunity for all to reach a state of equality. Popular collectivist movements, whether so-called progressive, reform, or socialistic, are significant in this connection chiefly as indirect admissions of this conclusion and of the correlative insistence on leveling down rather than up to a common denominator. Progress, as Condorcet put it, meant an unlimited perfectibility of man. In practice, these movements were the opposite; they were attacks upon all who conspicuously excelled. From another angle, a process of rationalization of the collapse of a dream was in order; a scapegoat was needed, hence the passing of the frontier and closed space served the purpose. These things were not done with conscious deliberation, and they do not imply any intent of deception or violation of integrity. They were the inevitable consequence of an effort, during a period of social transition, to explain the crumbling of an ideal, a social symbol, based upon nothing more substantial than an unproved faith clothed in an emotional appeal to hope.

The process of statistical analysis of mass data reveals that any large body of units falls into a fairly uniform pattern—a few at the top, a few at the bottom, and the mass distributed between the extremes. There is never equality of each and every unit, and no two units are ever equal. Nature does not create identical things, and history never repeats. Within a physical or biological organization, equilibrium is not maintained through absolute equality of all component parts. In plant and animal communities a relative equilibrium is maintained through the unstable balancing of a complex combination of biological and physical forces. A disturbance of any one or more of these forces tends to unchain an unpredictable sequence of results—a grasshopper scourge, an epidemic of disease, a war. The upsetting of the balance also sets in motion opposing forces that tend to reestablish equilibrium. The place of the individual in the community depends upon his individual contribution to the process of maintaining or disturbing equilibrium and not upon equality with other units of force. The same principle applies to species and races—there are differences, not equality. The position of each individual, species, and race in the community depends upon the contribution each makes to the unstable equilibrium of the whole. There can be no claim to equality

[28] Carl Becker, *Progress and Power*(Stanford, 1936); and *The Declaration of Independence*(New York, 1922), J. B. Bury, *The Idea of Progress*(London, 1921).

of status as a matter of right. It is an inexcusable offence against society, when the facts are available, for anyone for political purposes, to arouse hopes based upon false premises which in their very nature cannot be fulfilled. The outcome of such demagoguery can only be social tragedy. Nature does not tolerate uniformity; only man is guilty of proposing to regiment society. The ideas of quality and equality are contradictory. So far as the idea of equality is valid, it is not as an objective, only as a procedure, as a means to an end. The important thing is not equality but opportunity. Even though there was no assurance of everyone being capable of achieving distinction, there must be a reasonable freedom for quality to express itself in difference. The eighteenth-century philosophy of equality, although invalid in fact, was nevertheless a stimulant to hope which persisted so long as there was thought to be a reasonable freedom for the emergence of the individual. Just what constituted that margin of opportunity cannot be measured statistically, but it was substantial, and in part it was an attitude of mind. Psychologically, hope and the sense of personal importance and power rest upon mobility in space or status, or, most completely in both. The notion of a closed world, with the consequent loss of hope which began to depress the end-of-the-century era, was in part a frustration born of anticipation rather than the fact of an immobilized society which would narrow the margin of opportunity to the vanishing point. The loss of hope was fatal. In the twentieth century, the outcome became defeatism, frustration, and a refuge in regimentation and pursuit of social security. The eighteenth-century idea of equality was an appeal to the individual to assert himself. The twentieth-century revival of the doctrine was an appeal to the individual to throw himself passively upon the all-protecting arm of government and the escape mechanism of the totalitarian dream world, much as the Medieval man had taken refuge in the church and other-worldliness. The eighteenth-century equality was a philosophy of hope and liberty. The twentieth-century equality became the watchword of a regimented security, a full belly without freedom. The twentieth century, in its second quarter, traded off hope for fatalism.

Education

With the emergence of popular government and equalitarianism a special importance came to be attached to education, and there evolved a threefold objective: preparation for citizenship, earning a living, and happiness. In the interest of citizenship, the state took over education from the church and private schools and set out to provide a minimum for all. Associated with this was the assumption that education would render every voter equally capable of participation in government. In a vocational objective the parent wanted education for his child as a means of improving social status and escaping from hard work, especially from manual labor. By placing a stigma upon manual labor, equalitarianism was indulging in contradiction and was destroying itself. The addition successively of high school, college, professional and graduate school training to the objectives reduced the whole matter to the absurdity of "degree-itis" as a substitute for intelligence. During the depression of the thirties, many incompetent Ph.D's insisted upon proudly starving rather than doing an honest day's work and bitterly denounced a society that did not provide a privileged position for the so-called college man and woman. Still the graduate schools continued to turn out more and lower grade persons with high sounding degrees on a mass production basis. To make a practical application to the problem of agriculture, farming as an occupation has been injured more vitally by this false vocational objective of escape from work instead of a preparation for more effective work, than from all the traditional enemies of the farm combined—trusts, monopolies, bankers, middlemen, speculators, and even politicians.

The third objective of education, personal happiness, was largely lost in the confusion, contradictions, and hypocrisy of modern Education, spelled with a capital E, and laboratory science. The ideal of a liberal education once centered largely around the ancient classics, the literature of the Christian religion, the modern language classics, the individualistic traditions of the English common law, and a direct contact with nature. However badly they were often misused, these repositories of civilization contained enduring values and provided a common denominator of facts and ideas for western civilization. Most of that heritage has been abandoned in the machine age for things that are ephemeral and under the peculiar excuse of preparing for life.

After World War I, disillusionment and defeatism reacted sharply against the idea of his-

toricity in any form. This was a natural reaction from the prewar Progressive movement, the idea of the perfectibility of man through his own efforts as a historical process. That optimistic dreamworld collapsed in the face of reality. Partly out of the reaction and the laudable determination that it should never happen again came the Presentist movement. The past and civilization were pronounced a mistake and a proof of stupidity, selfishness on the part of leaders of the past, and corruption or betrayal. Only the immediate present was important, and the world and man were to be made over as the Presentist thought they ought to be. This was also called Progress with the present and regimented dreamworld of the future as the only points of reference. His personal judgment as a self-appointed messiah was the sole guide. Consciously or unconsciously,—the laboratory scientist, the automatic machine, the environmental determinist, the social scientist, the opportunistic politician, the collectivist-totalitarians who sympathized with Russia, Italy, or Germany, and several varieties of the lunatic fringe of reformers who habitually seize the opportunity to attach themselves to a rising tide of social change all contributed to a dominance of this point of view. The laboratory scientist lives in an artificially controlled little world and under such controls he produces his discoveries. The analogy was simple. If the world outside the laboratory could be placed under such artificial control, what were the limits to remaking the world and man? The machine offered similar certainties in performance at the hands of man. Among geographers, psychologists, and biologists, the cults of environmental determinism arose to repudiate genetics.

The social scientists adapted these analogies to their fields, repudiating history which was so largely the mother of their disciplines. Educators, representing a similar philosophy of egoism, gained the ascendency in the school system. The fantastic dreams of a remade society of the future offered to many merely an escape from ugly reality. All of this fits closely into the revival of eighteenth-century equalitarian natural rights, much in the spirit of Rousseau; man was perfect by nature and all were equal, but society destroyed man's birthright, and therefore society as the product of the past should be destroyed, and the twentieth-century socialist of the several varieties would remake the world as he thought it ought to be. The eighteenth-century French philosophy of natural rights had attacked the Ancient Regime and attempted to set up the extreme order of Jacobinism, that culminated in the Reign of Terror. In the twentieth century the "New Deal" drew a somewhat similar contrast with the "Old Deal," by heaping ridicule upon the Constitution, the Fathers of the Republic, the idea of the reign of law, and "the horse and buggy days." The desperate condition of the world during the economic collapse of 1932–1933 afforded the opportunity for the combination and culmination of the several tendencies. A curious conglomeration of frustrations, inconsistencies, paradoxes, idealism, and hypocrisy produced a tragic defeatism with a childish determination to repudiate history, human experience, and the unpredictability of man and nature.

Education became the particular victim of the combined Presentist attack, expecially in what is known as the social science field where it was taken over largely by the New Deal collectivist extremists who made the teacher's desk the soap box for partisan propaganda in the early 1930s. Many college professors accepted governmental jobs which identified them with partisan politics, and yet they expect their work to be accepted by the professional world as objective scholarship. They impose one rule upon members of the profession who hire out to private corporations to write history, economics, political science, or sociology but claim immunity for themselves from that rule and the stigma of violation of professional ethics when they hire out to a partisan governmental agency for the same purpose. Some individuals are tough-fibered enough to refuse to compromise integrity with any paymaster, corporation or government, but as a rule of action for the profession, the two situations are on a par and should be measured accordingly by the professional code of ethics.

The origins of academic freedom were rooted in the right of the scholar to carry out research in his laboratory or study without interference and in the right to teach and promulgate the results of such creative thought. The scholar was the source and generator of new ideas. In recent years, however, protection of academic freedom has been invoked for quite different practices. Remote from any pretense of creative scholarship, the instructor has taken controversial or partisan subjects into the classroom where he acted as an agitator or entered the public forum on such issues and at the

same time claimed an immunity from public criticism which other citizens do not enjoy. Since the radical elements have seized control, they have not only taken partisan propaganda into the schools but also tried to supress teachers who refused to submit to their intolerance and bigotry. The professional organizations that in the past have so zealously sought to protect academic freedom against outside influences and especially reactionary forces have failed in this age of totalitarian tendencies to meet the real issue. The case might be put more strongly. The cause of academic freedom has been betrayed by its false friends who took advantage of the opportunity to do the identical things that they have so strongly condemned others for doing. Until they put their own house in order, they have forfeited the right to speak in the name of academic freedom.

By 1944 the reactionary forces are already mobilizing a counterattack. Private business is advancing funds to institutions and to individuals for research and is bluntly stating the issue. If it is ethical to accept government funds for special purposes, it is equally ethical to accept private funds to the same extent and for similar purposes. The logic is inescapable, but both propositions are wrong. Education should be financed out of general funds, and both institutions and individuals should be free from special obligations to either private or governmental sponsors who have any interest in the results. If a sudden overturn of political control at Washington placed reactionary forces in control, the tables might be turned with a vengeance. In the future air age, with its totalitarian tendencies and threat of centralization through federal financing and a department of education, it is imperative that the standards of professional ethics shall be redefined in terms that recognize the central government as the most powerful force in society threatening freedom in education, and, in the broadest sense, the whole system of mass communication of intelligence.

The American Civil War did not come because a majority wanted it but because the unreasonable and intolerant extremists on both sides were permitted to drive a reluctant nation into conflict. Another civil war is a possibility, and if the extremists of the right and left are permitted to confuse the issues it will become a probability. Russia, Italy, Germany, and France should be object lessons. As for the extremists, they are hopeless and only invite what they call martyrdom. They should not be humored by persecution, or shooting, or hanging. They might possibly be given psychiatric treatment that in some cases would restore them to society as useful citizens. The great majority of moderates have a duty to maintain stability in the nation at large and to save true freedom of creative scholarship and teaching from destruction as in Europe.

The schooling process falls far short of producing the articulate generation skilled in the tools of the mind which the facilities of the scientific age would seem to make possible. Little or no study of the Latin or Greek languages to throw light upon English, or of the modern languages to open direct communication with contemporaries, produced a type of cultural incompetence and isolationism that is more serious than the failure to join the League of Nations or to lower tariff barriers. Methods of mass classroom teaching, including visual aids, the radio, transcribed lessons, and the lecture system call for little effort on the part of the student and no training in the art of expression. Whatever their value for certain special purposes when used exclusively as tests of knowledge, objective examinations are the capstone of a system in which the student has only to affix an X, the signature of the illiterate, to his record. It is possible for a student to graduate from college with Phi Beta Kappa honors without even having learned to construct a complete English sentence. Such a schooling process is almost completely passive and contributes to the making of a nation conditioned to control by the propaganda techniques of the totalitarian state. Education must be founded upon discipline of the mind, rigid training in the use of skills, and precision and competence in the expression of ideas in the English language and preferably in a second language as well. Francis Bacon's phrase is as sound in the twentieth century as when he wrote it: "Reading maketh a full man, conference a ready man, and writing an exact man."

Modern education stresses largely the laboratory sciences and vocational, technical, and professional training. These have no permanence and are largely out of date almost before the ink is dry on the diplomas. Sometimes, but not always, they provide a means of earning a living, but they do not provide something to live by which should be the function of liberal education as distinguished from vocational and professional training. The test of culture is often to be found in a man's ability

to live with himself, especially in personal or social adversity. With due allowance for individual exceptions, highly trained specialists as a class in such circumstances are conspicuously helpless and bewildered citizens, and the scientist, deprived of the comfortable certainties of his laboratory by realities of life, is no exception.

To serve its function, education should provide men with a common fund of ideas which possess enduring values determined by the seasoning and winnowing of time and that have survived the centuries because they have provided successive generations with something to live by. The greater the acceleration of change the more important becomes the grounding of education on a foundation of those things that are timeless and spaceless.

The centuries are built into the respective civilizations of Europe, Asia, and America, and a few enduring values should be common to all—the larger number to Western Europe and additional ones to the several national cultures. An educational program for an air age should enlarge the common fund through study of the great literatures, philosophies, religions, and systems of ethics, as well as the history of the whole world, not just Western Europe and America. At the same time, the significant differences, arising from environment, nationality, race, religion and other cultural heritages, must necessarily persist. There must be enough that is common to provide cohesion and enough that is different to afford free outlets for individual nonconformity so that "a philosophy of the mean" prevails in education. In the differences lie creative opportunity, and in the common fund the foundation for working together in a world society.

Religion

When the problems of religion and ethics are examined, failures in adjustment to the changes effected by science and machines are even more conspicuous than in the political field. The whole social experience of man, until the recent age, has been through revealed religion. Civilization has been based upon the contact of man with nature, and religious concepts were framed in terms of man's interpretation of natural phenomena and emerged while the race was relatively primitive. Science and rationalism in the Western world destroyed revealed religion without supplying a substitute. The machine culture severed the connection with nature. The scientific age has produced many new gadgets and prolonged the physical life of man, but it has deluded itself by calling these Progress. To what purpose? In a conspicuous way these accomplishments have been turned to immediate physical pleasure and the pursuit of power. Science and machines have been peculiarly effective in supplying the means for both these ends without much sense of responsibility for the outcome. Frequently, science has claimed the ability to solve the mystery of life when at best it can only restate it in different terms and should admit this limitation. Science explains the how, not the why, and can explain the how only in a limited sense. By explanations of the how, it can push the mystery back a few steps, but the mystery persists. In the last analysis revealed religion and science are equally dependent upon blind faith differing only in the manner of the revelation.

In its early history Christianity was concerned primarily with preserving the human soul and the other world, rather than with improving this one. Yet its greatest contribution to the social theory of western civilization was its emphasis on the value of the individual and the sacredness of human life. The Christian religion was unique among the world's great religions in this respect and poses a most formidable, if not insuperable, obstacle to effective understanding between the people of the East and the West. It is significant, also, that although the Medieval church preserved the individualism, it insisted upon the priesthood serving as an intermediary between man and God thereby blocking the fuller development of the rôle of the individual in history. Protestantism, and English Protestantism in particular, in its over-all development, made its most significant contribution through its insistence upon the right of nonconformity of the individual. The battle was long and bitter; national nonconformity started with the break with Rome, congregational nonconformity with the Separatists, and individual nonconformity with Roger Williams, the Seeker, and the Quakers. If the passing of the frontier was to result in a challenge to the survival of individualism, even more serious was the loss of a vital hold by Christianity upon the Western world.

The air age brings all the great religious systems into contact, if not conflict, and all, including the Christian are decadent. The Columbian world was introduced not only by printing, a new scien-

tific spirit of inquiry, and geographical discovery, but also by the Protestant movement, one of the most virile religious impulses in the history of civilization. At this opening of the air age, however, there is no comparable awakening to challenge the trend of religious decadence. Humanitarianism is neither a religion nor a substitute for it, but only an ethical social attitude. As important as they undoubtedly are, the offer of a mechanical gadget or a bottle of milk is no substitute for religious faith. Man wants something more than a number in a card index. Besides, humanitarianism possesses the unfortunate tendency of paternalism which would perpetuate an underprivileged class for the gratification of the benefactor.

Until the mystery of life is solved, man must have religion, and there is no prospect of finding the ultimate cause. It would be a dull world indeed if there was no mystery. Religion must provide some kind of answer to the riddle of man and the universe; not a final answer, but one that is sufficiently satisfying to provide large groups of men with something to live by. Without any sense of where and how he fits into the whole of things, individually and collectively, man loses his sense of direction, his sense of proportion and standard of values. Probably the greatest failure of the machine age is in religion. Out of the experience of centuries grew the several great religious ideas common to all, that may serve as a foundation for new ideas thereby continuing the only process known to man for creative thought, that of proceeding from the known to the unknown. Religion is an interpretation in compelling terms of the mystery of life and of the relation of man to the concept of God; and to retain vitality it must be restated continuously in terms suitable to changing conditions and the enlargement of human knowledge.

Ethics for the Machine Age

Until the latter part of the nineteenth century, human relations were grounded in what might be called the ethics of nature in contrast with the new requirements of the ethics of machines. Formerly, the larger portion of humanity was in direct contact with the good earth and natural forces. Civilization was primarily agricultural or not so far removed as to escape its influence more or less directly. In nature, much depends upon the unpredictable forces beyond man's control. Agriculture is always more or less a gamble with nature and economic forces in which man's best efforts are often partially or completely frustrated. Constantly, man was reminded of his accountability to nature and of the limitations and uncertainties of the forces which controlled his destiny—the weather; diseases and parasites of plants and animals; and the endurance, strength, and speed of animal power.

The machine age and cities separate man largely from contact with nature. For example, much of the great literature of the world possesses only a vague meaning to a generation that does not know a robin, a wild rose, an oak, a stalk of corn, wheat, or domestic animals. In machines, there is an appearance at least of certainty, precision, predictability, and not least of all, power beyond the wildest dreams of men of the American Revolution. All of this feeds man's egoism and sense of mastery. Machines and nature became rivals in competing for the interest of man and his experience with machines incited imagination. Machines won over nature and may win over man also. They place in his hands power without accountability, without the limitations which nature exacts but with an impersonality which so largely separates man from the consequences of his acts and invites abuse. The interdependence of men in a mechanized society introduced in new forms the problem of placing both personal and social responsibilities. The individual is seldom called upon to choose between a clear-cut issue of right and wrong, even granting that such distinctions exist. He is required frequently, however, to select the lesser from among several courses of action all of which he may disapprove. The question should be faced candidly whether an individual can be held responsible, either legally or ethically, for consequences which are the result of acts of commission or noncommission, advertent or inadvertent, of several persons who might have contributed. Can one person be held responsible for consequences of interdependent (not collective) action? If some individuals are excused from responsibility, what may be the extent of abuse of power? The problem, power without responsibility, posed by mechanical machines is paralleled by social organization which presents a similar problem, and every extension of government or private organization as an agency of the social group makes it more insistent. The problem of arbitrary power in government as a public question has received more

attention than the ethical and legal questions of personal power and responsibility of the individual within the social structure where mechanical and social machines open so many new possibilities of abuse. The first century of machines aroused what is known as the social conscience but in a warped fashion limited mostly to attacks up n abuse of the economic power of accumulated wealth. This was too much in the spirit of the pitting of one social group against another, a self-righteous majority against a minority, the have-nots against the haves. The problem of the ethics of machines is quite different because it must apply to every member of society who wields the power of machines, either the mechanical or the social machines. It is relatively immaterial to this discussion whether or not the power of accumulated wealth continues as a factor in society. The problem of individual and social ethics in a mechanized society involves the majority as well as a minority, and consequently, all who are participants in this mechanized Going Concern.

Essentials of Permanence and Change

In any attempt to analyze during this early stage of the machine culture (1840–), and especially during these beginnings of the air age phase, there is danger, if not certainty, that contemporaries in these initial steps will take themselves too seriously. Under the circumstances it may be more important to ask questions than to answer them. Time has not yet intervened with its mellowing influence and perspective. It is customary for each older generation to worry about the new. That is because the world always has changed at a rate that partially outmoded each generation before the lapse of a normal life span. But, as has no doubt been said in each instance before, this one is different. Automatic power machines have introduced the highest rate of change yet known, and the air age phase of society based on the internal combustion engine and electricity, especially as applied to communications, has created a totally new situation for man, and in consequence this generation is obliged to recognize the impact of the phenomenal foreshortening of time on the problem of human adjustment. There has never been any substitute for time, and without minimizing the importance of human intelligence, the admission must be made that it has never proven a substitute for time. At best it has only served as a supplementary factor, and at worst it has all but caused disaster.

The cyclic swings in human behavior, as between radicalism and conservatism, have been not only accelerated, but in extent they seem to have become more violent or extreme. In the past, with time as a moderating corrective, one extreme tended to offset the other, and in the long view, effected something of a working philosophy of the mean. But under the impersonal driving influence of the machine, the question persists whether there is not an over-all progressive deterioration in man's success in maintaining a safe margin of stability in the unstable social equilibrium. The problem is more than a breakdown of a particular institution or policy. The whole fabric of civilization is out of harmony with the fundamental change in its foundations from a nature civilization to a scientific machine civilization. Institutions are functional. Technology moves rapidly; institutions change slowly. A time lag in the adjustment of one to the other is unavoidable. But when the culmination of technological change from time to time becomes revolutionary, institutions cannot be modified with much success until there is some degree of stabilization and some agreement upon the underlying nature and meaning of the change. The most optimistic attitude to assume is that after all, one hundred years of mechanical-powered communications is not long in terms of the history of the race.[29] On the other hand, the stakes at issue in the bombing of Britain in 1940 or General Montgomery's successful defense of Alexandria in 1942 are a vivid reminder of the narrow margin by which civilization was saved from disaster.

No two persons have agreed exactly on what the essentials of civilization have been or ought to be, and it will be a social tragedy if they ever do; but nevertheless, the importance of candid examination is insistent. First in importance must be a recognition and admission of the extent of the air-age revolution. It may be necessary to discard in part or as a whole certain features, including private property, the primitive characteristics of Christianity, the equalitarian tradition, the dogma of universal suffrage, and the Idea of Progress,

[29] The hundred years of the machine age(*c.* 1840–1940), with mechanically powered communications, may be conveniently divided into three phases for a clearer analysis: Preliminary spread of the telegraph and railroads in small units, *c.* 1840–1875; the period of the ocean cable(1866), the compound marine steam engine, and consolidation of business organization, *c.* 1875– ; the air age, *c.* 1940– , when recognition was imposed by disaster.

that have been valued highly. Among the newer objectives to be attained are religious ideas adequate for a scientific and rational age, systems of ethics in keeping with the dominant rôle of the impersonalized machine, and means for accelerating in democracy the machinery of accurate popular decision and efficient action and insuring that it be truly popular. Among the essentials to be continued and preserved are the principles of a government of law responsible to an effective popular opinion, the preservation of a social fluidity that will assure the margin of opportunity for the emergence of quality from any level of the social system, and the security of the individual as the ultimate creative force in history.

No interpretation of history that is not grounded on the individual and on natural forces can stand the test. The cult of science, the machine, and planned society would like to convince the world otherwise, but their claim of ability to escape from nature and its limitations is more superficial than real. In the long run all are subject to the unpredictability of natural forces, and man, for all his pretense of civilization, is still almost as uncertain in behavior as his early ancestors. As in primitive times, man must have a scapegoat for his sins, and a hero for the personification of his aspirations. To serve his function adequately, the historian must go behind the symbols and chart the course of history as a cumulative folk process.

When man has made a particularly conspicuous collective fool of himself he needs a scapegoat and American history has used several, including John Quincy Adams, Stephen A. Douglas, Andrew Johnson, Grover Cleveland, William H. Taft, Woodrow Wilson, Warren G. Harding, and Herbert Hoover. Of these Harding was the least worthy in his own right, but in most respects he was probably a well meaning man who was more sinned against than sinning. Douglas, Johnson, and Cleveland were men of moderate ability but with an integrity of purpose that has been vindicated in belated fashion by history. Adams, Taft, Wilson, and Hoover are among the ablest men who have occupied the presidential office; they would not sacrifice their own ideal of right to mere demagoguery. In any case, they paid the price that the primitive in man exacts when he has occasion to become particularly self-righteous. There should be some method, less costly socially, by which society might purge its guilty conscience.

Man's heroes are chosen with a similar lack of discrimination. Such opposite characters as Lincoln and John Brown were made heroes by the same generation and without any consciousness of the unfitness of things. It is immaterial whether the particular heroic qualities attributed to Lincoln and Brown belong to the men themselves—certainly they did not belong to Brown—but by peculiar combinations of circumstances they became attached to the memories of these men as folk legends and the elaboration continues. Such legend-making typifies the aspirations of the several kinds of people who created the legends and are in some measure at least projections of themselves into history.

The hero theory has been particularly attractive to those who know little history and has undergone a conspicuous revival under the combined influences of the Presentists, totalitarians, and dictators. In the sense of creativeness, few, if any, of the heroes of the legends can stand the test of historical criticism. Intimately detailed historical studies of most of man's great achievements reveal a folk process not a hero. The creative work of the world is primarily the achievement of little people, each of whom makes his contribution, usually unheralded, in line of duty, as part of the task of daily living. These accumulations of little things are eventually crystallized into what history calls new discoveries, inventions, or ideas that become significant through synthesis. This is the folk process, although in dramatized form the credit is often assumed by some individual or assigned to some hero, or a little of both.[30] Sometimes, however, the synthesis is in reality the achievement of an unusual personality. How much organized research of the machine age in the scientific laboratory or elsewhere has modified or will modify that process can hardly be answered at this stage, but so far as verifiable experience is concerned the folk process is fundamental in any age. The extent of the folk process is in danger of being obscured, however, by pretentious organization, complex laboratory equipment, and the selfish vainglory of the administrator. In organization there is power both to develop and to destroy. It

[30] James C. Malin, *Winter Wheat in the Golden Belt of Kansas*(Lawrence, University of Kansas Press, 1944). This folk process is illustrated in the selection of new wheat varieties and in the invention of new machinery for corn and wheat culture in the sub-humid environment of Kansas. See also Louis C. Hunter, "The Invention of the Western Steamboat," *Journal of Economic History*, 3:201–220(November 1943).

remains to be seen whether it has the intelligence to perform the former function. A peculiar responsibility rests with the organizers and administrators of research to keep open the avenues by which the natural process can continue from the bottom up rather than to attempt to impose artificial procedure from the top down. The supremacy of the latter would mean the suicide of civilization. The essence of democracy must be found in something more than the forms of government; it is an order of society and a way of life that permits individuals the freedom to live creatively. During the Columbian era the right of private property was associated conspicuously with individualism and to many it was thought of as a test of individual liberty, but this peculiar relationship between the individual and property is limited in modern times and seems to be in transition to a new status. More universal and timeless for the individual is the right of nonconformity, the liberty of person and the mind, and the right of difference in contrast with the imposition of equality and uniformity. The urge to create is a characteristic of life. So long as truth has not been found, man demands the right of freedom in his continued search, and for those who have within them the capacity to act creatively, there is no alternative to individual liberty.

NEWS NOTES AND COMMENTS

JEFFERSON BICENTENARY

The Agricultural History Society is one of the scientific and learned societies with a representative on the National Agricultural Jefferson Bicentenary Committee, a special commission created by Congress to sponsor activities commemorating and publicizing Thomas Jefferson's contributions to agriculture. Dr. Theodore R. Schellenberg of the National Archives is the Society's representative on the Committee. He will welcome suggestions from the membership of the Society concerning ways and means of honoring Jefferson, and the editor of *Agricultural History* will be glad to receive articles on Jefferson and agriculture for inclusion in the journal.

DECEMBER 1943 MEETING

The Agricultural History Society met with the American Historical Association and other historical societies at Barnard College in New York City on December 29–30, 1943. The Society's joint session on Wednesday morning, December 29, consisted of a symposium on "Tenancy and Land Tenure" with Dean Harry J. Carman of Columbia University presiding. The speakers and papers were: Dr. David M. Ellis, University of Vermont, "Land Tenure and Tenancy in the Hudson Valley, 1790–1860"; and Dr. LaWanda F. Cox, Hunter College, "Tenancy: A Step toward Farm Ownership? (1865–1900)." This program was arranged by Dr. Paul W. Gates of Cornell University.

THE HISTORY OF WESTERN RANGE RESEARCH

Prepared by

DIVISION OF RANGE RESEARCH, FOREST SERVICE,
UNITED STATES DEPARTMENT OF AGRICULTURE[1]

INTRODUCTION

Range research furnishes basic information, guides, and procedures for the intelligent use and management of range lands for grazing. The growth of this field of science in relation to the western range has been gradual, following the development of the West and reflecting the increasing realization of the need for more and still more facts to obtain the highest use and maximum benefits of the Nation's vast resources. The collection of information on western grazing started with the notes and observations made by early explorers, military leaders, and missionaries. Range research progressed very slowly during the opening and settling of the western grazing grounds by the cattle kings and homesteaders.[2] Its real growth began in response to the necessities arising from the Federal policy of forest reservation and administration, for administration of the forest reserves made regulated use of the range just as necessary as regulated utilization of the timber. The building up of a sound body of scientific knowledge was needed to restore depleted forage, protect watersheds, stock ranges to grazing capacity during suitable seasons, and apply better methods for handling livestock on the range. Unfortunately the development of range research has lagged far behind the need, and the lack of knowledge has contributed in a large part to the serious range deterioration that still exists on large areas. Although some formal grazing experiments were begun by 1910, the development of range research has approached the needed comprehensive program only since about 1935. This development has been the result of recognition of the value and need for range research accompanied by intensified use of public and private ranges in a progressive national agriculture enterprise.

In the growth of range research, both Federal and State agencies have played important parts, the leading role being taken by the Federal Government through the Department of Agriculture. Chronologically, range research may be said to fall into four broad periods: 1, The exploratory period prior to 1905; 2, Limited intensive studies, 1905–1909; 3, Organized experiments undertaken throughout the mountainous West and the Great Plains, 1910–1927; and 4, Expanded research accompanying aggressive public action on range problems, 1928 to present.

The purpose of this paper is to recount the beginnings of western grazing research in the United States and to give recognition to subsequent significant developments, supported by examples of published work, for the benefit of the many workers in this and related fields. However, it is impossible within the limits of these few pages to list all publications or specifically mention all the many range studies and workers contributing to this important field of agricultural research.

THE EXPLORATORY PERIOD PRIOR TO 1905

Three distinct kinds of observations are characteristic of the exploratory period. The first was the discovery and description of many of the native

[1] Prepared under supervision of William Ridgely Chapline, Chief, Division of Range Research, by Robert S. Campbell, Senior Forest Ecologist, Division of Range Research; Raymond Price, Director, Southwestern Forest and Range Experiment Station; and George Stewart, Senior Forest Ecologist, Intermountain Forest and Range Experiment Station. Reviewed by James T. Jardine, Chief, Office of Experiment Stations, Department of Agriculture; Herbert A. Smith, formerly Assistant Chief, in charge of Public Relations, and later Historian, Forest Service (retired); Arthur W. Sampson, Professor of Forestry, University of California; William A. Dayton, in charge, Dendrology and Range Forage Investigations, Forest Service; and the Bureaus of Plant and Animal Industry of the Department of Agriculture.

[2] For the history of range use, see Will C. Barnes, "The Story of the Range," 69 Cong., 1 sess., U. S. Senate, Hearings before a Subcommittee on Public Lands and Surveys, *National Forests and the Public Domain*, 2:1578–1640 (1926); George Stewart, "History of Range Use," 74 Cong., 2 sess., "The Western Range," *Senate Doc. 199*, p. 119–133 (1936); and other general treatises on this subject. A good early report is E. V. Wilcox, "The Grazing Industry," Hawaii Agr. Expt. Sta., *Spec. Bul.* (91 p., 1911).

plants growing on the range. A very important role in this respect was played by the early military expeditions in the West, such as those of Lewis and Clark, Emory, Abert, Frémont, Ives, Stansbury, King, and Wheeler. Many of these American soldiers took a keen personal interest in the native vegetation through which they passed, personally collecting plants and writing notes about them. Often associated with these early expeditions were military surgeons, such as Cooper, Newberry, and Rothrock, or others who served as botanists, such as Berlandier, Fendler, and Gregg, Nuttal. Many of the plants collected were sent to the outstanding botanical authorities of the day, such as Torrey, Gray, and Engelman for identification and description. There were also collectors, such as Douglas and Jeffrey, sent out by British horticultural and botanical centers, and early missionaries such as Spalding and Father De Smet. The second kind of observation includes the early notations of western pasture and range problems by agricultural specialists, mainly on particular areas already suffering serious damage from grazing. The third, near the end of the period, comprises the exploratory surveys and investigations by Department of Agriculture personnel of the general range situation pertaining to the forest reserves, which above all others indicated the real necessity of range research.[3]

It was natural that a number of the botanists, engaged in compiling plant lists, observed the general effects of grazing by livestock on vegetation. Many of their notes and incidental observations laid the groundwork for the later and more detailed observations of grazing resources and conditions, as contained in publications of the U. S. Department of Agriculture.[4]

[3] A chronological list of a few of the more important publications characterizing the work of the early botanists follows: Thomas Nuttall, *The Genera of North American Plants, and a Catalogue of the Species, to the year 1817* (Philadelphia, 1818); Sir William Jackson Hooker and G. A. Walker Arnott, *The Botany of Captain Beechey's Voyage . . . in the Years 1825, 26, 27 and 28* (London, 1830–41); David Douglas, "A Sketch of a Journey to the North-Western Parts of the Continent of North America, During the Years 1824, 5, 6, and 7," in Sir W. J. Hooker, *Companion to the Botanical Magazine*, 2:82–140 (1836); John Torrey and Asa Gray, *A Flora of North America* (New York and London, 1838–43); Charles A. Geyer, "Notes on the Vegetation and General Character of the Missouri and Oregon Territories, Made . . . during the Years 1843 and 1844," *London Journal of Botany*, 4:479–492, 653–662; 5:22–41, 198–208, 285–310, 509–524 (1845–46); W. H. Emory, "Notes of a Military Reconnoissance from, Fort Leavenworth, in Missouri, to San Diego, in California . . . ," 30 Cong., 1 sess., *House Exec. Doc. 41* (1848); J. G. Cooper and Asa Gray, "Report on the Botany of the Route," "Reports of Explorations and Surveys, to Ascertain the most Practicable and Economical Route for a Railroad from the Mississippi River to the Pacific Ocean," 36 Cong., 1 sess., *Senate Exec. Doc.*, 12(2):7–76 (1860); W. H. Brewer, Sereno Watson, and Asa Gray, *Botany* (Cambridge, Mass., 1876–80); J. T. Rothrock, and others, "Reports upon the Botanical Collections Made in Portions of Nevada, Utah, California, Colorado, New Mexico and Arizona, during the years 1871, 1872, 1873, 1874, and 1875," U. S. Army, Engineer Dept., *Report upon United States Geographical Surveys West of the One Hundredth Meridian, Botany*, v. 6 (1878); Thomas Howell, *Catalogue of the Flora of Oregon, Washington, and Idaho* (Arthur, Ore., n.d.); John M. Coulter, *Manual of the Botany (phaenogamia and pteridophyta) of the Rocky Mountain Region, from New Mexico to the British Boundary* (New York and Chicago, 1885); Asa Gray, "Synoptical Flora of North America," Smithsn. Inst., *Misc. Collect.*, v. 31 (1886); and John M. Coulter, "Botany of Western Texas," U. S. Dept. Agr., Div. Bot., *Contributions from the U. S. National Herbarium*, v. 2 (1891–94).

In addition, the general botanical works were expanded into rather complete catalogs for specific parts of the West in which the names of the following botanists were prominent: Charles E. Bessey, Nathaniel L. Britton, T. D. A. Cockerell, Frederick V. Coville, Alice Eastwood, Edward L. Greene, Amos A. Heller, Willis L. Jepson, Clinton H. Merriam, George C. Nealley, Aven Nelson, Charles C. Parry, Charles V. Piper, Per Axel Rydberg, Jared G. Smith, Paul C. Standley, George Vasey, Sereno Watson, and Elmer O. Wooton. The naming of new plant species after these early workers makes their names familiar to present-day range men.

[4] For examples, see Samuel P. Boardman, "Sheep Husbandry in the West," U. S. Dept. Agr., *Rpt.*, 1862, p. 286–299; "Grasses on the Plains and Eastern Slope of the Rocky Mountains," "The Pastoral Lands of America," and "The Texas Cattle Trade," *ibid.*, 1870, p. 217–226, 301–310, 346–352; George Vasey, "Grasses for Texas," *ibid.*, 1881–82, p. 231–232, and "Grasses of the Great Plains," *ibid.*, 1883, p. 83–98; F. W. Anderson, "The Pastoral Resources of Montana," *ibid.*, 1888, p. 311–324; "Experiment Grass Station at Garden City, Kans.," *ibid.*, 1889, p. 380–382; George Vasey, "The Agricultural Grasses and Forage Plants of the United States; and Such Foreign Kinds as Have Been Introduced," U. S. Dept. Agr., *Rpt. 32* (revised ed., 1889); F. Lamson-Scribner, "Grasses as Sand and Soil Binders," U. S. Dept. Agr., *Yearbook*, 1894, p.

In 1868, six years after the creation of the Department of Agriculture, its fourth division, the Division of Botany, was established. Until its dissolution in 1934, this Division was an important center of botanical activity in the Department. Prior to 1893, it took a prominent part in the botanical exploration of the Far West and in publication on the range plants of that area. Dr. George Vasey, the first Botanist of the Department, and chief of this Division, served under Major John Wesley Powell in his western explorations and wrote many papers on western range plants.[5]

By 1880, the upswing of the rapidly expanding range-livestock industry was having economic consequences that attracted serious attention. The demand began to be formulated for a more definite form of remedy for the accumulating and alarming evils of unregulated range use. This was signalized by the inclusion in the agricultural appropriation act for the fiscal year 1896 of a $15,000 item (a substantial item, in those days, for a new line of work) for grass and forage-plant investigations. On the basis of this appropriation the Department of Agriculture organized the Division of Agrostology on July 1, 1895. This Division, although largely preoccupied with botanical work, recognized many of the current grazing problems.[6]

With the creation of the forest reserves in the Department of the Interior, such as the enormous Cascade Range Forest Reserve in 1893 extending all the way from the Columbia River to the California line, many pressing problems of grazing affecting divergent public interests came to the fore. The following quotation from the Division of Forestry's *Bulletin 15*, published in 1898, is apropos:

> From the time the Cascade reserve was created there was a difference of opinion among the people of Oregon regarding the effect of sheep grazing within its limits, one party to the controversy maintaining that the sheep were a serious detriment to the interests for which the reserve was created, the other maintaining that they were not. The first official action taken by the Government was the issuing of regulations, under date of April 14, 1894, governing all the forest reserves, and, among other details, prohibiting the "driving, feeding, grazing, pasturing, or herding of cattle, sheep, or other live stock" within any of the reserves.[7]

These public reactions resulted in a movement to get the reserve greatly cut down—a course advocated in 1896 by the Oregon delegation in Congress. To quote again from *Bulletin 15*: ". . . the Interior Department felt the need of a disinterested investigation of the facts before formulating any detailed set of rules. The aid of the Department of Agriculture was solicited, and the result of the investigation is here presented."[8]

Dr. Frederick V. Coville, then Chief of the Division of Botany, was chosen to make this investigation because at that time he was the outstanding exponent in governmental circles on the subject of range grazing and the possibilities of systems of governmental leasing to overcome the evils of overstocking and land misuse. Coville's study, made in the summer of 1897, resulted in definite recommendations of measures to control the evil effects of sheep grazing not by prohibiting but through regulation and management. The report expressly stated that the recommended measures were designed to apply specifically to the conditions in the Cascade Mountains and should

421–436; and Jared G. Smith, "Forage Conditions of the Prairie Region," *ibid.*, 1895, p. 309–324, and "Forage Plants for Cultivation on Alkali Soils," *ibid.*, 1898, p. 535–550.

[5] Among these early publications by George Vasey are the following: "Loco Weeds," U. S. Dept. Agr., *Rpt.*, 1884, p. 123–125; "Report of an Investigation of the Grasses of the Arid Districts of Texas, New Mexico, Arizona, Nevada, and Utah, in 1887," (parts are signed by S. M. Tracy, G. C. Nealley; 2 are unsigned) U. S. Dept. Agr., Div. Bot., *Bul. 6* (1888); "The Agricultural Grasses and Forage Plants of the United States; and Such Foreign Kinds as Have Been Introduced," U. S. Dept. Agr., *Rpt. 32* (revised ed., 1889); "Grasses of the Southwest," U. S. Dept. Agr., Div. Bot., *Bul. 12* (1890–91); and "Grasses of the Pacific Slope Including Alaska and the Adjacent Islands," U. S. Dept. Agr., Div. Bot., *Bul. 13* (1892–93).

[6] The following U. S. Department of Agriculture Division of Agrostology bulletins are illustrative: H. L. Bentley, "A Report upon the Grasses and Forage Plants of Central Texas," *Bul. 10* (1898); Thomas A. Williams, "Report upon the Grasses and Forage Plants and Forage Conditions of the Eastern Rocky Mountain Region," *Bul. 12* (1898); Jared G. Smith, "Grazing Problems in the Southwest and How to Meet Them," *Bul. 16* (1899); and Cornelius L. Shear, "Field Work of the Division of Agrostology: A Review and Summary of the Work Done since the Organization of the Division, July 1, 1895," *Bul. 25* (1901).

[7] Frederick V. Coville, "Forest Growth and Sheep Grazing in the Cascade Mountains of Oregon," U. S. Dept. Agr., Div. Forestry, *Bul. 15*, p. 10 (1898).

[8] *Ibid.*, 7.

not be considered as necessarily applying in regions where the conditions were different. However, it was not long before the Department of the Interior had to confront the same problem of what to do about grazing in forest reserves where conditions were quite different.

The Black Mesa and San Francisco Mountain forest reserves were both proclaimed on August 17, 1898. The Salt River Valley irrigationists were in arms against sheep grazing on the headwaters of the streams from which their water supplies came. The following spring, Secretary Ethan A. Hitchcock of the Department of the Interior prohibited all grazing on both these reserves. The prohibition was generally disregarded that summer, but in the fall the stockmen organized to protect their interests and sent two of their number as representatives to Washington, of whom one was Albert F. Potter.

Potter arrived about the time that Secretary Hitchcock asked the Department of Agriculture's Division of Forestry to supply working plans and other technical advice on reserve administration. Arrangements were made in 1900 for Gifford Pinchot, outstanding leader of American conservation and Chief of the Division of Forestry, Coville, and Potter to go to the Southwest together for a joint study of the grazing situation. This investigation was carried through in June of that year and bore highly fruitful results that were greatly multiplied in later years. Before his Arizona field trip with Coville and Potter was ended, Pinchot had asked Potter to come to the Division of Forestry. He joined up the following year. At the request of the Public Lands Commission, Potter and Coville made an exploratory survey of the condition of public lands by means of a questionnaire. Their report, published by the Forest Service with the title, "Grazing on the Public Lands," as its *Bulletin 62* (1905), brought about a proposal for federally regulated use of the public domain grazing lands, a proposal never lost sight of until it finally produced a response in the Grazing Act of 1934.

In 1901, the divisions of Agrostology and Botany were absorbed in the newly formed Bureau of Plant Industry within which their studies of forage plants, reseeding, and grazing were continued.[9] Two years later, the Santa Rita Range Reserve was established in southern Arizona to protect a large area of native range land from grazing. Upon the suggestion of Coville, the Carnegie Institution of Washington established the Desert Laboratory at Tucson, Arizona, in the fall of 1903, for fundamental studies of desert plants.

Some of the State agricultural experiment stations were becoming interested in phases of range management during this early period. Robert H. Forbes, Director, Arizona Agricultural Experiment Station, for example, recognized the importance of range studies, particularly as a means of correlating the use of the range for grazing and as a source for water, in his article on "The Open Range and the Irrigation Farmer" in the *Forester*, 7:216–219, 254–258 (September, October 1901). Other examples of the work of the State stations are P. Beveridge Kennedy and Samuel B. Doten's "Preliminary Report on the Summer Ranges of Western Nevada Sheep," issued as Nevada Agricultural Experiment Station *Bulletin 51* (1901) and a somewhat similar publication by P. B. Kennedy, "Summer Ranges of Eastern Nevada Sheep," issued as Nevada Station *Bulletin 55* (1903); also John S. Cotton's "A Report on the Range Conditions of Central Washington," Washington Agricultural Experiment Station *Bulletin 60* (1904).

In this early period, several State stations, especially Wyoming, Colorado, Nevada, and Texas, made chemical analyses of a rather large number of native range plants. Henry G. Knight in Wyoming was among the more active workers in this field.

LIMITED INTENSIVE STUDIES, 1905–1909

In 1905, the forest reserves were transferred from the Department of the Interior to the Department of Agriculture and consolidated with the Bureau of Forestry to form the Forest Service. More detailed exploratory investigations of grazing were

[9] Among the U. S. Bureau of Plant Industry bulletins pertaining to the range are the following: David Griffiths, "Range Improvement in Arizona," *Bul. 4* (1901); Joseph Burtt-Davy, "Stock Ranges of Northwestern California: Notes on the Grasses and Forage Plants and Range Conditions," *Bul. 12* (1902); H. L. Bentley, "Experiments in Range Improvement in Central Texas," *Bul. 13* (1902); David Griffiths, "Forage Conditions on the Northern Border of the Great Basin," *Bul. 15* (1902), "Forage Conditions and Problems in Eastern Washington, Eastern Oregon, Northeastern California, and Northwestern Nevada," *Bul. 38* (1903), and "Range Investigations in Arizona," *Bul. 67* (1904); and J. S. Cotton, "Range Management in the State of Washington," *Bul. 75* (1905).

immediately started to help solve the many problems of range-land management and use. The number of livestock on the range was near its peak, and the newly formed Forest Service had immediately to deal with a fully established grazing industry that had grown great on free range. It was necessary to allocate grazing privileges to cattlemen and sheepmen engaged in bitter feuds for their "range rights" and to the homesteader attempting to defend his small holdings from both. In the midst of this chaotic and precarious scramble for forage, range use on the national forests had to be regulated, grazing fees imposed, forage restored, "sore spots" healed, and watersheds protected.

The objective of sustained productive range on which to build a sound grazing enterprise and to provide economic family units led the Forest Service to start studies of how to increase the productivity of range, particularly as related to range-sheep management, which was then a very live problem. In 1907, the Forest Service, in cooperation with the Bureau of Plant Industry, and under the general planning and direction of Potter and Coville, set out to obtain additional information basic to the use of the range by sheep. Coyote-proof pastures, started at that time, afforded opportunity to study the natural habits of sheep and also some of the important factors in the handling of sheep, such as disturbance from predatory animals, losses due to dense timber, availability of water, and camp sites. Studies of growth habits and requirements of important range plants furnished information for determining grazing capacity and developing ways of using the forage consistent with the requirements of the vegetation of certain range types on the Wallowa National Forest in Oregon. Studies were also made of the reseeding of depleted mountain meadows with cultivated forage plants as a means of improving the forage supply, first in Oregon, then on forest ranges in other parts of the West.

These studies were handled by James T. Jardine and Arthur W. Sampson, the two pioneers in national forest-range research. Their accumulations of biological data on habits and requirements of sheep and growth of native range forage furnished a basis for approaching a natural adjustment, as far as practicable, in the use and management of the range, especially for sheep, and led to the bedding-out system of grazing, water development, better seasons of grazing, deferred and rotation grazing, and other improvements of range practice including range surveys.[10]

The Santa Rita Range Reserve was enlarged in 1907 and studies of grazing capacity were undertaken by the Bureau of Plant Industry there.[11] In 1909, studies of the eradication of chaparral by goat grazing were begun on the Lassen National Forest in California by John H. Hatton, Inspector of Grazing.[12] Several of the State agricultural experiment stations also continued their exploratory range investigations during this period with two rather comprehensive publications in the Southwest.[13]

ORGANIZED EXPERIMENTS THROUGHOUT THE MOUNTAINOUS WEST AND GREAT PLAINS, 1910–1927

The setting up of the Office of Grazing Studies in the Forest Service in Washington, D. C., in 1910, headed by James T. Jardine (now Chief of the Office of Experiment Stations, U. S. Department of Agriculture), was the beginning of formal recognition of range research as an important and

[10] The publications resulting from these early studies include the following: James T. Jardine, "Preliminary Report on Grazing Experiments in a Coyote-proof Pasture," U. S. Forest Service, *Circ. 156* (1908), and "The Pasturage System for Handling Range Sheep; Investigations during 1909," U. S. Forest Service, *Circ. 178* (1910); and Arthur W. Sampson, "The Revegetation of Overgrazed Range Areas. Preliminary Report," U. S. Forest Service, *Circ. 158* (1908), "Natural Revegetation of Depleted Mountain Grazing Lands. Progress Report," U. S. Forest Service, *Circ. 169* (1909), "The Reseeding of Depleted Grazing Land to Cultivated Forage Plants," U. S. Dept. Agr., *Bul. 4* (1913), "Range Improvement by Deferred and Rotation Grazing," U. S. Dept. Agr., *Bul. 34* (1913), "Natural Revegetation of Range Lands Based upon Growth Requirements and Life History of the Vegetation," U. S. Dept. Agr., *Jour. Agr. Res.*, 3:93–148 (1914), and "Important Range Plants: Their Life History and Forage Value," U. S. Dept. Agr., *Bul. 545* (1917).

[11] E. O. Wooton, "Carrying Capacity of Grazing Ranges in Southern Arizona," U. S. Dept. Agr., *Bul. 367* (1916).

[12] John H. Hatton, "Eradication of Chaparral by Goat Grazing; Lassen National Forest," U. S. Forest Service, *Review of Forest Service Investigations*, 2:25–28 (1913).

[13] E. O. Wooton, "The Range Problem in New Mexico," N. Mex. Agr. Expt. Sta., *Bul. 66* (1908); and J. J. Thornber, "The Grazing Ranges of Arizona," Ariz. Agr. Expt. Sta., *Bul. 65* (1910).

needed field of investigation. This office was under the Branch of Grazing, of which the Assistant Chief of the Forest Service, Leon F. Kneipp, was in charge from 1910 to 1914, and Will C. Barnes from 1915 to 1929. Under Jardine's leadership many practical tests of grazing use were developed and applied. Additional intensive, yet comprehensive, research also was undertaken in several localities. When Jardine left the Forest Service in 1920 to become Director of the Oregon Agricultural Experiment Station, the leadership of the Office of Grazing Studies passed to W. Ridgely Chapline. Chapline continued in charge also after transfer of the office to the Branch of Research in 1926. At that time Earle H. Clapp was Assistant Chief of the Forest Service, in charge of the Branch of Research.

An important contribution by Jardine during this period was the development of a system of range-resource inventory as a basis for better range management. This system, then called grazing reconnaissance and now termed range survey, stemmed from his sheep studies at Billy Meadows, Oregon, in 1907. It was tried on national-forest ranges in 1910, using individual workers. In 1911, range surveys were started on a party basis on other national forest ranges. The basic procedures of this range-survey system have not been substantially modified, although new methods and procedures have been evolved. The system is now widely used and has greatly contributed to the better understanding and application of range-management planning.

Following the establishment of the Forest Service Office of Grazing Studies in Washington, regional offices were set up in the western national-forest regions. The first were organized in 1911 in the Pacific Northwest, Intermountain, Rocky Mountain, and Southwestern regions, with Charles E. Fleming, Alfred E. Aldous, Lynn H. Douglas, and Robert R. Hill in charge, respectively. Fleming took charge of a similar office in the Northern Rocky Mountain region in 1913 and Jesse L. Peterson later took charge in the Pacific Northwest. In 1915, a grazing-study office was established in the California region with Fred D. Douthitt in charge. Homer S. Youngs took over the Northern Rocky Mountain office in that same year.

The purpose of these regional offices of grazing studies was to develop and adapt grazing practices for greater application to regional problems of national-forest grazing. The studies undertaken were on pressing administrative problems regarding both cattle and sheep grazing and special emphasis was directed toward correlating grazing use with other uses of the range, such as watershed protection and timber production. They also helped to build up a substantial body of knowledge regarding the occurrence, reproduction, and economic values of range plants.

The studies of western national forest range-plant values, growth requirements, and distribution were placed under the supervision of William A. Dayton in 1911.[14] The formal identification of the plant material was handled through cooperation with Frederick V. Coville by Edward L. Greene, Ivar Tidestrom, Albert S. Hitchcock, Agnes Chase, and others in the Bureau of Plant Industry, the U. S. National Herbarium, and in other cooperating institutions.[15]

The study of grazing in relation to erosion and floods was begun in 1910 on the Manti National Forest in Utah by Robert V. R. Reynolds.[16] Studies of grazing in relation to timber reproduction were started in 1910 on the Coconino National Forest in Arizona by Hill and later on the Shasta National Forest, California, by Sampson and Dayton, on the Malheur National Forest, Oregon, by Fleming, and the Payette National Forest, Idaho, by William N. Sparhawk.[17]

[14] The first comprehensive results were presented in U. S. Forest Service, *Notes on National Forest Range Plants*; *Part 1, Grasses* (1914), largely prepared by William A. Dayton and W. R. Chapline.

[15] Important among the publications based in part on this work are: Agnes Chase, *First Book of Grasses, the Structure of Grasses Explained for Beginners* (New York, 1922); Ivar Tidestrom, "Flora of Utah and Nevada," Smithsn. Inst., U. S. Natl. Mus., *Contributions from the National Herbarium*, v. 25 (1925); A. S. Hitchcock, "Manual of the Grasses of the United States," U. S. Dept. Agr., *Misc. Pub. 200* (1935); and Thomas H. Kearney, Robert H. Peebles, and collaborators, "Flowering Plants and Ferns of Arizona," U. S. Dept. Agr., *Misc. Pub. 423* (1942).

[16] Robert V. R. Reynolds, "Grazing and Floods: A Study of Conditions in the Manti National Forest, Utah," U. S. Forest Service, *Bul. 91* (1911).

[17] Arthur W. Sampson and William A. Dayton, "Relation of Grazing to Timber Reproduction. Shasta National Forest," U. S. Forest Service, *Review of Forest Service Investigations*, 2:18–24 (1913); Robert R. Hill, "Effects of Grazing Upon Western Yellow-Pine Reproduction in the National Forests of Arizona and New Mexico," U. S. Dept. Agr., *Bul. 580* (1917); and W. N. Sparhawk, "Effect of Grazing upon Western Yellow Pine Reproduction in Central Idaho," U. S. Dept. Agr., *Bul. 738* (1918).

Some of the special range- and livestock-management studies made during this period are noteworthy. Studies of the possibilities of eradicating tall larkspur as a means of preventing cattle losses as the result of poisoning were initiated by Aldous in 1913.[18] Livestock watering places on western grazing lands were surveyed by Barnes in 1914 and studied more thoroughly in the Southwest by Murrell W. Talbot later.[19] The initiation of the study of national-forest range used by goats in New Mexico by Chapline in 1915 was expanded on a general basis to goat ranges of Arizona, California, and Oregon two years later.[20] Studies regarding the use of salt in range management were started in the Intermountain and Pacific Northwest regions in 1916. These were later extended to other western Forest Service regions and culminated in a more intensive study in the Southwest in 1920 by Talbot.[21]

Other range livestock management studies made during this period included the extension of tests of handling sheep on the range, particularly the bedding-out system begun earlier by Jardine; initial tests of grazing capacity on various national-forest ranges (1914), particularly on the Deerlodge (Montana), Caribou (Idaho), Targhee (Idaho), and Manti (Utah) ranges; and tests of the deferred and rotation system of grazing developed earlier by Sampson. Later, tests of grazing capacity, natural revegetation of ranges, poison-plant control, and other phases of management were extended generally throughout the western regions. Those who had an important part in these later studies include Mark Anderson, Talbot, Douglas C. Ingram, David A. Shoemaker, Arnold R. Standing, Thomas Lommasson, Fred P. Cronemiller, and others.

In addition to these studies, several special accomplishments of westernwide or national importance were obtained.[22] Important in these was the bringing together of basic principles of range management in published form under the title, "Range Management on the National Forests," U. S. Department of Agriculture, *Bulletin 790* (98 p., 1919), by James T. Jardine and Mark Anderson. This publication has constituted the "range bible" on which management generally has been based. Another major accomplishment was the extensive and detailed appraisal of national forest range lands with reference to grazing fees under Christopher E. Rachford.

The administrative grazing studies of this period proved of great value in establishing the broad general principles of grazing use. However, the need for more fundamental information on which to make adjustments in grazing became evident as problems such as floods and erosion became serious, threatening the range-livestock enterprise. As a consequence, in 1912, a range experiment station was established by the Forest Service on the Manti National Forest in central Utah at which more detailed and fundamental studies of range management, range erosion, and other grazing relationships could be studied. This field unit, known first as the Utah Experiment Station and later as the Great Basin, was organized by Jardine and Sampson. The latter remained in charge of the station until 1922, and as a result several Department of Agriculture publications of widespread importance were issued.[23] Clarence L. Forsling, now Assistant Chief, Forest Service, in charge of Forest Research, took charge of the Great Basin Station in 1922.

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[18] A. E. Aldous, "Eradicating Tall Larkspur on Cattle Ranges in the National Forests," U. S. Dept. Agr., *Farmers' Bul. 826* (1917).

[19] Will C. Barnes, "Stock-Watering Places on Western Grazing Lands," U. S. Dept. Agr., *Farmers' Bul. 592* (1914); and M. W. Talbot, "Range Watering Places in the Southwest," U. S. Dept. Agr., *Bul. 1358* (1926).

[20] W. R. Chapline, "Production of Goats on Far Western Ranges," U. S. Dept. Agr., *Bul. 749* (1919).

[21] W. R. Chapline and M. W. Talbot, "The Use of Salt in Range Management," U. S. Dept. Agr., *Circ. 379* (1926).

[22] Accomplishments of wide scope and importance are illustrated by the following reports and publications: Will C. Barnes and James T. Jardine, "Live Stock Production in the Eleven Far Western Range States," U. S. Dept. Agr., Off. Sec., *Rpt. 110*, Meat Situation in the United States, pt. 2 (1916); D. A. Spencer, and others, including Will C. Barnes, "The Sheep Industry," U. S. Dept. Agr., *Yearbook*, 1923, p. 229–310; C. V. Piper, and others, including W. C. Barnes, "Our Forage Resources," *ibid.*, p. 311–414; and L. C. Gray, and others, including W. R. Chapline, "The Utilization of Our Lands for Crops, Pasture and Forests," *ibid.*, p. 415–506.

[23] Chief among these were the following bulletins: Arthur W. Sampson and Leon H. Weyl, "Range Preservation and its Relation to Erosion Control on Western Grazing Lands," *Bul. 675* (1918); Arthur W. Sampson, "Climate and Plant Growth in Certain Vegetative Associations," *Bul. 700* (1918), "Effect of Grazing upon Aspen Reproduction," *Bul. 741* (1919), and "Plant Succession in Relation to Range Management," *Bul. 791* (1919).

Another significant development of the period was the transfer of responsibility for range research outside the national forests from the Bureau of Plant Industry to the Forest Service in 1915. This added responsibility resulted in the inauguration of additional intensive studies of the relation of climate to range-plant growth and use and studies of methods of range management on semidesert ranges at the Jornada and Santa Rita experimental ranges in New Mexico and Arizona with Charles E. Fleming initially in charge. The Jornada Range Reserve had been established in 1912 under the supervision of Elmer O. Wooton. Fleming was followed on the Jornada in turn by Leon C. Hurtt, now in charge of range research at the Northern Rocky Mountain Station, by Forsling, by Enoch W. Nelson, now Professor of Range Management at Colorado Agricultural College, and by Jacob D. Schoeller; and on the Santa Rita in turn by Rudolph L. Hensel, Hill, and Matt J. Culley.[24]

The temporary but drastic effect of the first World War upon range research of this period is typified by the following pithy note in the annual report of the Forester for the fiscal year 1917: "For the grazing season of 1917 investigations were largely discontinued, except at the Jornada Range Reserve and the Utah Experiment Station, where they were greatly curtailed, and all available qualified men were assigned to the emergency campaign to increase live-stock production."

After the war, intensive research and numerous administrative studies were again undertaken. Range surveys were rapidly expanded on national forests in all regions, especially to aid in making adjustments necessitated by the heavy stocking of the war period. Several special studies were initiated. The intensive study of grazing periods at the Great Basin Station is noteworthy. The studies of grazing in relation to watershed management, initiated in 1920 on the Tonto National Forest in Arizona by Talbot and continued by Nelson and Charles K. Cooperrider, helped to lay the foundation for recognition of the value of such studies in western watershed management.

Edward N. Munns' study of the erosion and flood problems in California included consideration of grazing of range lands. Hatton conducted a study which indicated how grazing could aid in fire control. The study of heavy utilization of browse ranges in Utah initiated by Sampson and Earle V. Storm and concluded under the direction of Forsling showed the disadvantages of such utilization. The research at the Jornada Experimental Range in New Mexico brought to a conclusion several important phases.[25]

Along the extreme eastern edge of the range territory, within the dry-land agricultural region, the Bureau of Plant Industry also started experimental pasture-grazing work early in this period. In 1915, grazing work was begun in cooperation with the North Dakota Agricultural Experiment Station at the Northern Great Plains Field Station at Mandan, under the direction of Johnson T. Sarvis. This work has been conducted on experimental pastures grazed by cattle since that time.[26]

Pasture-grazing experiments were also started at the Ardmore Field Station, Ardmore, South Dakota, in 1917, as a cooperative enterprise of the bureaus of Animal and Plant Industry. These experiments were planned largely by Sarvis and Floyd L. Kelso of the latter bureau and George M. Rommel and others of the former.[27]

[24] Some of the U. S. Department of Agriculture publications emanating from these studies are: James T. Jardine and L. C. Hurtt, "Increased Cattle Production on Southwestern Ranges," *Bul. 588* (1917); James T. Jardine and Clarence L. Forsling, "Range and Cattle Management During Drought," *Bul. 1031* (1922); C. L. Forsling, "Chopped Soapweed as Emergency Feed for Cattle on Southwestern Ranges," *Bul. 745* (1919), and "Saving Livestock from Starvation on Southwestern Ranges," *Farmers' Bul. 1428* (1924).

[25] Representative publications from this period include: John H. Hatton, "Live-stock Grazing as a Factor in Fire Protection on the National Forests," U. S. Dept. Agr., *Dept. Circ. 134* (1920); E. N. Munns, "Erosion and Flood Problems in California," Calif. State Board of Forestry, *Report to the Legislature on Senate Concurrent Resolution No. 27* (1923); Arthur W. Sampson and Harry E. Malmsten, "Grazing Periods and Forage Production on the National Forests," U. S. Dept. Agr., *Bul. 1405* (1926); C. L. Forsling and Earle V. Storm, "The Utilization of Browse Forage as Summer Range for Cattle in Southwestern Utah," U. S. Dept. Agr., *Circ. 62* (1929); and Enoch W. Nelson, "The Influence of Precipitation and Grazing Upon Black Grama Grass (*Bouteloua eriopoda*) Range," U. S. Dept. Agr., *Tech. Bul. 409* (1934).

[26] U. S. Department of Agriculture publications based on this work include: Johnson T. Sarvis, "Effects of Different Systems and Intensities of Grazing upon the Native Vegetation at the Northern Great Plains Field Station," *Bul. 1170* (1923); and J. M. Stephens, and others, "Report of the Northern Great Plains Field Station for the 10-Year Period, 1913–1922, Inclusive," *Bul. 1301* (1925).

[27] U. S. Department of Agriculture publications based on this work include: John S. Cole, and others, "Work of the United States Dry-Land Field Station, Ardmore,

The Bureau of Plant Industry also contributed in an important way to the ecological and physiological interpretation of native vegetation in agriculture and land management, particularly in the Great Plains. Typical results of this basic work are the reports by Homer L. Shantz on "Natural Vegetation as an Indicator of the Capabilities of Land for Crop Production in the Great Plains Area," and "Grassland and Desert Shrub."[28] The water requirement of a few native grasses and herbaceous plants was measured by Lyman J. Briggs and Shantz and of many others by Shantz and Lydia N. Piemeisel.[29]

Closely related to the range-vegetation studies and of importance in the whole correlated program of research pertaining to range lands and their use by domestic livestock are range animal husbandry investigations. The Federal Government, through the Bureau of Animal Industry, started studies pertaining to range-sheep breeding and improvement in 1906, in cooperation with the Wyoming Agricultural Experiment Station. With the establishment of the U. S. Sheep Experiment Station near Dubois, Idaho, in 1917, the range-sheep husbandry investigations were enlarged and brought under more complete control. Those concerned with the initiation and conduct of these studies at this station were Frederick R. Marshall, until recently executive secretary of the National Wool Growers Association; Damon A. Spencer, now in charge of sheep and goat husbandry investigations, Bureau of Animal Industry; Virgil O. McWhorter; William A. Denecke; and John M. Cooper.[30] In 1923, formal studies of range-sheep grazing were started at the U. S. Sheep Experiment Station by the Forest Service, in cooperation with the Bureau of Animal Industry.

In 1924, the Bureau of Animal Industry started formalized studies of range-cattle breeding and feeding with the establishment of the U. S. Range Livestock Experiment Station at Miles City, Montana, on the site of old Fort Keogh, a former military reservation. Studies with range sheep were also undertaken. Cooperation is maintained with the U. S. Forest Service and the Montana Agricultural Experiment Station. Those responsible for the start and conduct of these studies were Earl W. Sheets, former Chief of the Animal Husbandry Division of the Bureau of Animal Industry, and James R. Quesenberry, present Superintendent of the station.[31]

The Bureau of Animal Industry also established in 1915 an experiment station in central Utah, in cooperation with the Forest Service, for intensive study of livestock losses from poisonous range plants. Much of the groundwork for this phase of research was laid by the studies and writings of Victor K. Chesnut, Albert C. Crawford, Earley V. Wilcox, and later by C. Dwight Marsh, in charge for the Bureau of Animal Industry, and his assistants.[32]

Other investigations of a more general and overall character dealing with economic phases of range organization and range-livestock production made during this period are exemplified by the economic surveys during 1924 and 1925 by the Bureau of Agricultural Economics, the Bureau of Animal Industry, and the several State agricultural experiment stations in the Great Plains and the Southwest.[33]

South Dakota, 1912 to 1925," *Tech. Bul. 17* (1927); and W. H. Black and O. R. Mathews, "Wintering Steers in the North Central Great Plains Section," *Tech. Bul. 192* (1930).

[28] The first was issued as U. S. Bureau of Plant Industry, *Bul. 201* (1911); and the second as pt. 1, sect. E of the *Atlas of American Agriculture* (1924).

[29] See Lyman J. Briggs and H. L. Shantz, "The Wilting Coefficient for Different Plants and Its Indirect Determination," U. S. Dept. Agr., Bur. Plant Indus., *Bul. 230* (1912), "The Water Requirements of Plants," I-II, Bur. Plant Indus., *Bul. 284–285* (1913), and "Relative Water Requirement of Plants," U. S. Dept. Agr., *Jour. Agr. Res.*, 3:1–64 (Oct. 15, 1914); also H. L. Shantz and Lydia N. Piemeisel, "The Water Requirement of Plants at Akron, Colo.," U. S. Dept. Agr., *Jour. Agr. Res.*, 34:1093–1190 (June 15, 1927).

[30] A U. S. Department of Agriculture publication characterizing this work is J. M. Cooper, "Range Sheep Production," *Farmers' Bul. 1710* (1933).

[31] The U. S. Department of Agriculture publications covering this work include: W. H. Black, J. R. Quesenberry, and A. L. Baker, "Effect of Different Methods of Wintering Beef Calves, in the Northern Great Plains, on Winter Gains and Feed Costs and on Subsequent Summer Gains," *Tech. Bul. 529* (1936); and A. L. Baker, "Comparison of Alfalfa and Western Wheatgrass Hays for Wintering Yearling Heifers in the Northern Great Plains and Their Influence on Summer Gains," *Tech. Bul. 635* (1938).

[32] Numerous publications relating to livestock poisoning by individual poisonous plants have been issued as well as the comprehensive U. S. Dept. Agr. *Bul. 1245*, "Stock-Poisoning Plants of the Range," by C. D. Marsh (1924).

[33] The results of the two principal surveys were issued under the following titles: M. L. Wilson, R. H. Wilcox, G. S. Klemmedson, and V. V. Parr, "A Study of Ranch Organization and Methods of Range-Cattle Production in the Northern Great Plains Region," U. S. Dept. Agr.,

The State agricultural experiment stations expanded their studies pertaining to range lands during this period. Economic and range-animal husbandry phases received particular attention at many stations, as these problems are especially amenable to the organization and other facilities of the State stations.

Carefully planned studies of range management were also started by several States on experimental range areas. In 1915, funds were provided to establish the Ranch Experiment Station at Sonora, Texas. In the same year, the Kansas station began a study in the Flinthill grasslands near Manhattan in cooperation with Dan D. Casement, carried on later by Rudolph L. Hensel, and still later by Alfred E. Aldous. In 1916, Director Samuel B. Doten of the Nevada station inaugurated a program devoting a considerable part of the station's resources to range and range-livestock studies. Charles E. Fleming was brought in as range expert and work on livestock-disease control was also emphasized. Other States followed, many in cooperation with the Forest Service and the bureaus of Animal and Plant Industry of the U. S. Department of Agriculture.[34]

In 1922, Arthur W. Sampson joined the faculty of the University of California. There he initiated a number of rather fundamental studies of range management and issued three textbooks, largely embodying the experiences and information gained in his range-management studies in the Forest Service. These were *Range and Pasture Management* (New York, 1923); *Native American Forage Plants* (New York, 1924); and *Livestock Husbandry on Range and Pasture* (New York, 1928).

Numerous other workers at universities, colleges, and such endowed institutions as the Carnegie Institution of Washington made real contributions to various phases of range ecology during the period. An outstanding example is the pioneer work of Frederic E. Clements, who became permanently associated with the Carnegie Institution about 1917.[35] Forrest Shreve also is noted for his fundamental ecological studies of the relation of climate to plants, conducted at the Desert Laboratory of the Carnegie Institution of Washington at Tucson, Arizona.[36]

EXPANDED RESEARCH ACCOMPANYING AGGRESSIVE PUBLIC ACTION ON RANGE PROBLEMS, 1928 TO PRESENT

The general administrative studies of grazing use and the more or less localized range research of the Forest Service and other agencies prior to 1928 were of value in orienting and furnishing broad principles and guides for the use of range lands for domestic livestock grazing. Because of the great variation of vegetation, soils, and cli-

Tech. Bul. 45 (1928); and V. V. Parr, G. W. Collier, and G. S. Klemmedson, "Ranch Organization and Methods of Livestock Production in the Southwest," U. S. Dept. Agr., *Tech. Bul. 68* (1928).

[34] Publications illustrating the work of the State experiment stations during this period include: C. E. Fleming, "One-night Camps Versus Established Bedgrounds on Nevada Sheep Ranges," Nev. Agr. Expt. Sta., *Bul. 103* (1922); J. L. Lantow, "Factors Affecting Range Management. A Report from Cattlemen on the Factors which Affect the Percentage and Uniformity of the Calf Crop and the Development of the Calves to Maturity on the Range," N. Mex. Agr. Col., *Ext. Circ. 74* (1922); Bonney Youngblood, "An Economic Study of a Typical Ranching Area on the Edwards Plateau of Texas," Tex. Agr. Expt. Sta., *Bul. 297* (1922); A. F. Vass, "Range and Ranch Studies in Wyoming," Wyo. Agr. Expt. Sta., *Bul. 147* (1926); "Carrying Capacity of Pastures of the Ranch Experiment Station," Tex. Agr. Expt. Sta., *Ann. Rpt.*, 1927, p. 66–67; V. L. Cory, "Activities of Livestock on the Range," Tex. Agr. Expt. Sta., *Bul. 367* (1927); H. A. Lingren and E. L. Potter, "Management of Range Grazing Land," Oreg. Agr. Col., *Ext. Bul. 397* (1927); A. F. Vass and Harry Pearson, [Range and Ranch Studies in Wyoming: 2], "Range Sheep Production on the Red Desert and Adjoining Areas," Wyo. Agr. Expt. Sta., *Bul. 156* (1927); A. C. Esplin, William Peterson, P. V. Cardon, George Stewart, and K. C. Ikeler, "Sheep Ranching in Utah, Report of a Preliminary Economic Survey of the Ranch Situation as of 1925," Utah Agr. Expt. Sta., *Bul. 204* (1928); and G. H. Hart and H. R. Guilbert, "Factors Influencing Percentage Calf Crop in Range Herds," Calif. Agr. Expt. Sta., *Bul. 458* (1928).

[35] See Frederic E. Clements, "The Development and Structure of Vegetation," *Botanical Survey of Nebraska (Studies in the Vegetation of the State, 3)*, v. 7 (1904); "Plant Succession; An Analysis of the Development of Vegetation," Carnegie Inst. Wash., *Pub. 242* (1916); and "Plant Indicators, the Relation of Plant Communities to Process and Practice," Carnegie Inst. Wash., *Pub. 290* (1920).

[36] Forrest Shreve, "The Vegetation of a Desert Mountain Range as Conditioned by Climatic Factors," Carnegie Inst. Wash., *Pub. 217* (1915); and B. E. Livingston and Forrest Shreve, "The Distribution of Vegetation in the United States, as Related to Climatic Conditions," Carnegie Inst. Wash., *Pub. 284* (1921).

matic characteristics of western ranges—from the desert lands supporting sparse vegetation to the highly productive mountain meadows—there was need for a great deal more information from both empirical and formal studies. This need was reflected in the gradual expansion of range studies at many of the State experiment stations during the mid-twenties. The transfer of the Office of Grazing Studies from the administrative Branch of Grazing and its establishment as a division in the Branch of Research of the Forest Service in 1926 was another sign of the times. A special study was made of the needs for range research along with a consideration of the whole need for forest research, under the direction of the then Assistant Chief Forester in Charge of Research, Earle H. Clapp, now Associate Chief of the Forest Service, and Acting Chief, 1939 to 1942, inclusive. The findings were published by Clapp in a volume entitled *A National Program of Forest Research* (Washington, D. C., American Tree Association, 1926). The report established the need for a considerable expansion and coordination of the range work with other forest and agricultural research and set forth the responsibilities of all agencies in such an enlarged program. In large measure, this report formed the basis of an extended and intensified program of research authorized by the McSweeney-McNary Forest Research Act of 1928. This basic act authorized experiments and investigations under the direction of the Secretary of Agriculture, among other things, to develop improved methods of management of forest or other ranges consistent with the growing of timber and the protection of watersheds at forest and range experiment stations, or elsewhere, and authorized appropriations for such work. The passage of this act marked a new epoch in range research.

The new epoch had from the start three important phases. The first was the consolidation of all Forest Service range experimental work under regional forest and range experiment stations. This made possible more intensive and plan-wise action and brought about a coordinated research program on the whole forest- and range-land problem, with studies of range, forest management, watershed management, forest economics, and forest products. Each of these major fields of research now is headed by divisions of the Forest Service in Washington, D. C., and all of these divisions are under the direction of the Assistant Chief in Charge of Research. Capable and inspiring leadership was given the whole research organization by Clapp until 1936, and since 1937 by Forsling, an outstanding worker and leader in range research. The second phase was the development of more extensive cooperation with the various State agricultural experiment stations and several bureaus of the Department of Agriculture, resulting in the coordination of range research on a nationwide basis and its integration with other agricultural research. The third is the considerable expansion and intensification of the research itself, made possible by congressional appropriations under the financial authorizations of the McSweeney-McNary Act and for a period from emergency funds made available in connection with the Civilian Conservation Corps, the National Industrial Recovery effort, the Works Progress Administration, and other emergency programs.

Research in range management and range improvement, including artificial range revegetation and values and use of range-forage plants as authorized by the McSweeney-McNary Act, is conducted under the direction of the Division of Range Research of the Forest Service, of which Chapline is Chief. This research is organized along three main lines, namely, grazing management, artificial revegetation, and range-forage investigations.

Grazing-management research is conducted with a view to developing methods of management for lands producing native forage. It involves the determination of the grazing capacity of various range types, ways and means of restoring and maintaining better forage plants, improving methods of handling livestock on ranges, controlling losses from poisonous plants, reducing the fire hazard by grazing, and harmonizing grazing with timber production, wildlife, and other land values.[37] Certain phases of this work are handled

[37] Representative Department of Agriculture publications in this field of research issued during the period are: M. W. Talbot, "Indicators of Southwestern Range Conditions," *Farmers' Bul. 1782* (1937); G. W. Craddock and C. L. Forsling, "The Influence of Climate and Grazing on Spring-Fall Sheep Range in Southern Idaho," *Tech. Bul. 600* (1938); Edward C. McCarty, "The Relation of Growth to the Varying Carbohydrate Content in Mountain Brome [*Bromus carinatus*]," *Tech. Bul. 598* (1938); R. H. Canfield, "The Effect of Intensity and Frequency of Clipping on Density and Yield of Black Grama [*Bouteloua eriopoda*] and Tobosa [*Hilaria mutica*] Grass," *Tech. Bul. 681* (1939); David

in cooperation with the Bureaus of Animal and Plant Industry, the Soil Conservation Service, and State agricultural experiment stations.

To implement this research a number of new experimental ranges, branch stations, and work centers have been established. Important among these are: Desert Experimental Range, Utah, established in 1933 for grazing-management studies on winter sheep ranges; San Joaquin Experimental Range, California, established in 1934 for study of grazing management and reseeding on yearlong annual-type foothill ranges; Central Plains Experimental Range, Colorado, established in 1937 to study spring-summer-fall grazing management on shortgrass cattle range; and Starkey Experimental Range, Oregon, established in 1940, for study of grazing-management practices on pine-bunchgrass ranges grazed by cattle.

Studies in artificial revegetation include the determination of what native species justify selection for improvement, of the true possibilities in adapting native and introduced species to seeding or transplanting, and how these can be most economically established on range lands. This expanded program has been centered largely at the Intermountain and Northern Rocky Mountain Forest and Range Experiment stations where region-wide studies are being conducted at numerous representative work centers. Revegetation studies have, however, been conducted in other parts of the West, especially in Arizona, New Mexico, California, and Oregon.[38] The revegetation research is being conducted in cooperation primarily with the Bureau of Plant Industry and the various State agricultural experiment stations.

The basic objective of the range-forage investigations is to collect, analyze, and disseminate information on the identity, distribution, growth requirements, life histories, and forage and watershed protective and other values of range plants. A range-plant herbarium of about 100,000 specimens is maintained and includes the most complete collection of annotated western American montane plants in existence.[39] In this work cooperation is maintained with the Bureau of Plant Industry, the National Museum, and various agencies and individuals who are specialists in the plant-identification field. In 1942, this project was combined with the dendrological work of the Forest Service as the Office of Dendrology and Range Forage Investigations, with Dayton in charge.

Until 1937, range-watershed studies also constituted a major line of research handled by the Division of Range Research. In that year these studies were combined with the forest-watershed phases under the new Division of Forest Influences of the Forest Service, with Edward N. Munns as Chief. Cooperation on phases of this work is also maintained with State and other Federal agencies. These watershed studies have for their purpose the determination of the relation of brush and herbaceous cover to erosion, streamflow, and ground water; the effects of grazing, and how overgrazed and eroded areas can be reclaimed and their watershed values restored.[40] In recent years determina-

F. Costello and Raymond Price, "Weather and Plant-Development Data as Determinants of Grazing Periods on Mountain Range," *Tech. Bul. 686* (1939); R. S. Campbell and Edward C. Crafts, "How to Keep and Increase Black Grama on Southwestern Ranges," *Leaflet 180* (1939); and G. D. Pickford and Elbert H. Reid, "Basis for Judging Subalpine Grassland Ranges of Oregon and Washington," *Circ. 655* (1942).

[38] Publications of the U. S. Department of Agriculture characterizing this field of investigation include: C. L. Forsling and William A. Dayton, "Artificial Reseeding on Western Mountain Range Lands," *Circ. 178* (1931); Raymond Price, "Artificial Reseeding on Oak-Brush Range in Central Utah," *Circ. 458* (1938); George Stewart, R. H. Walker, and Raymond Price, "Reseeding Range Lands of the Intermountain Region," *Farmers' Bul. 1823* (1939); John T. Cassady and George E. Glendening, "Revegetating Semidesert Range Lands in the Southwest," U. S. Civilian Conservation Corps, *Forestry Pub. 8* (1940); and L. R. Short, "Reseeding to Increase the Yield of Montana Range Lands," *Farmers' Bul. 1924* (1943).

[39] From this research have come many valuable notes and articles and several Departmental publications, including: William A. Dayton, "Important Western Browse Plants," *Misc. Pub. 101* (1931); W. A. Dayton, comp., "Glossary of Botanical Terms Commonly Used in Range Research," *Misc. Pub. 110* (1931); and U. S. Forest Service, *Range Plant Handbook* (1937).

[40] The publications of the U. S. Department of Agriculture characterizing the type of these studies include: H. H. Bennett and W. R. Chapline, "Soil Erosion a National Menace," *Circ. 33* (1928); C. L. Forsling, "A Study of the Influence of Herbaceous Plant Cover on Surface Run-off and Soil Erosion in Relation to Grazing on the Wasatch Plateau in Utah," *Tech. Bul. 220* (1931); Reed W. Bailey, C. L. Forsling, and R. J. Becraft, "Floods and Accelerated Erosion in Northern Utah," *Misc. Pub. 196* (1934); F. G. Renner, "Conditions Influencing Erosion on the Boise River Watershed," *Tech. Bul. 528* (1936); Barnard A. Hendricks, "Vine-Mesquite for Erosion Control on Southwestern Ranges," *Leaflet 114* (1936); Charles K. Cooperrider

tion of and recommendations for desirable practices to apply on range lands within western watersheds have been included in the cooperative surveys under the Flood Control Act.

Economic phases of range research by the Forest Service are now handled by the Division of Forest Economics Research, of which Verne L. Harper is Chief. Formalized studies by the Forest Service along this line are relatively new, having started at the Intermountain Forest and Range Experiment Station at Ogden, Utah in 1938 with Mont H. Saunderson in charge. During the past years, however, some phases of this work were handled as part of grazing-management research.[41]

Field work in western Forest Service range research is conducted chiefly by the six regional forest and range experiment stations of the Forest Service in the West.[42] Grazing-management studies of forest ranges in the southeastern coastal plain were started by the Appalachian Station in 1939 and in Louisiana and the Gulf States by the Southern Station in 1943. The geographic location of the regional stations and branch field stations and work centers are shown on the accompanying map.

Certain range research project work of westernwide or nationwide character, such as the Range Forage Investigations Project, is handled either in or through the Divisional Office in Washington.

Another project of westernwide scope, similarly directed from Washington by Chapline and Frederick W. Furst, was the Western Range Survey. This was a cooperative endeavor among the several bureaus of the Department of Agriculture, the Department of the Interior, and State agencies interested in range-land use. Its purpose was to assemble available range-survey material of acceptable standard and to prepare range-management plans for selected counties for coordinated

and Barnard A. Hendricks, "Soil Erosion and Stream Flow on Range and Forest Lands of the Upper Rio Grande Watershed in Relation to Land Resources and Human Welfare," *Tech. Bul. 567* (1937); George W. Craddock and C. Kenneth Pearse, "Surface Run-Off and Erosion on Granitic Mountain Soils of Idaho as Influenced by Range Cover, Soil Disturbance, Slope, and Precipitation Intensity," *Circ. 482* (1938); and Reed W. Bailey and A. R. Croft, "Contour-Trenches Control Floods and Erosion on Range Lands," U. S. Emergency Conservation Work, *Forestry Pub. 4* (1937).

[41] For an example of this type of work, see Matt J. Culley, "An Economic Study of Cattle Business on a Southwestern Semidesert Range," U. S. Dept. Agr., *Circ. 448* (1937).

[42] A brief historical description entitled *Experimental Ranges and other Range Research Centers of the Forest Service* was brought together in mimeographed form by Edward C. Crafts in 1938.

use in bettering the management by all interested agencies. The bulk of this work on a national basis was completed in 1937 and 1938 but the project stimulated much similar work throughout the western States. Active conduct of the project as such is now terminated, but interbureau and interdepartmental regional committees formed in connection with the project are still functioning in considering range survey and use problems.

The present utilization-standards research of the Forest Service deals with the determination of proper grazing use of the various important western range-forage species and types. The urgent need for such information on national forest ranges led to the request for a special study from the administrative Division of Range Management, of which Walt L. Dutton is Chief. A cooperative western-wide project with Robert S. Campbell in charge was initiated in 1936 under the Division of Range Research. During the first three years, available information on range utilization and condition was brought together into regional utilization handbooks, mainly applicable to the national forests. In 1939, the emphasis was shifted to a study of basic factors influencing utilization of forage plants on the range and a more adequate determination of proper utilization of various types with the active field research centered at the Pacific Northwest, Intermountain, and Southwestern forest and range experiment stations.

A work indispensable to all range-research workers was the compilation by Fred G. Renner and others of more than 8,000 important references to range literature which was published under the title, "A Selected Bibliography on Management of Western Ranges, Livestock, and Wildlife," as U. S. Department of Agriculture *Miscellaneous Publication 281* (1938).

The Forest Service also has continued through the years to draw together information on range as a national resource. Forest-range problems were included in *A National Plan for American Forestry*, better known as the Copeland Report.[43] A more comprehensive statement of the western range as a great natural resource, its problems, its place in the national economy, and a program for its sound management, was submitted to Congress by the Secretary of Agriculture and published in 1936 as *The Western Range*.[44] Every year brings requests to the Division of Range Research for preparation of reports of national scope on some phase of the range situation. Reports were prepared, for example, for the National Resources Planning Board in 1935 with regard to land available for range and also in 1942 on public works and range land in relation to the post-war period. The relation of the range to the broad aspects of the agricultural problem has also been covered in a number of recent Department of Agriculture Yearbooks.

Improvement of research methods has been given constant attention. In addition to numerous articles through the years in various technical journals, suggestions of individual Forest Service members were incorporated in *Proceedings of Range Research Seminar* (414 p., mimeographed, U. S. Forest Service, 1939).

The Bureau of Animal Industry has continued its major range animal husbandry studies at the U. S. Sheep Experiment Station, the U. S. Range Livestock Experiment Station, and the Ardmore Field Station. Also, in 1935 the Bureau of Animal Industry entered into a cooperative agreement with the Bureau of Indian Affairs of the Department of the Interior to conduct sheep-breeding and wool investigations at the newly established Southwestern Range and Sheep Breeding Laboratory at Fort Wingate, New Mexico. John M. Cooper, formerly Superintendent of the U. S. Sheep Experiment Station, is director of the laboratory. In 1937, the range sheep husbandry work of the Bureau of Animal Industry at the U. S. Sheep Experiment Station was also enlarged by the addition of the Western Sheep Breeding Laboratory, a regional laboratory serving the eleven far-western States and Texas and conducted in cooperation with the agricultural experiment stations of these States. Julius E. Nordby is the director of the laboratory and the sheep station. Verner I. Clark is now in charge of the Ardmore Station. The animal-husbandry work of the Bureau of Animal Industry comes under the general direction of Hugh C. McPhee, Chief, Animal Husbandry Division in Washington, D. C.[45]

[43] A National Plan for American Forestry, U. S. Forest Service, 73 Cong., 1 sess., U. S. Senate, *Doc. 12* (1677 p., 1933).

[44] "The Western Range—a Great but Neglected Natural Resource," U. S. Forest Service, 74 Cong., 2 sess., U. S. Senate, *Doc. 199* (620 p., 1936).

[45] Representative U. S. Department of Agriculture publications covering this work include: J. M. Cooper

A recent extension of pasture cattle grazing studies in the eastern range dry-land agricultural belt is the grazing work and genetic studies of native grasses at the Southern Great Plains Field Station at Woodward, Oklahoma, started in 1941. This is a cooperative study by the bureaus of Plant and Animal Industry and the Soil Conservation Service of the Department of Agriculture, and the Oklahoma Agricultural Experiment Station. The groundwork for the grazing studies was laid by Ellery F. Chilcott, former Superintendent of the Woodward station. The plans for the work and active direction are handled by David A. Savage of the Bureau of Plant Industry.[46]

Of especial importance in western grazing research during the current period is the plant-breeding program now headed up by Olaf S. Aamodt, in charge of the Division of Forage Crops and Diseases, Bureau of Plant Industry. Plant breeding and selection work centers of the Bureau of Plant Industry are located at points throughout the West and work closely with the several State and Federal agencies engaged in range-improvement work. Closely related to these studies are the regional nurseries maintained by the Soil Conservation Service for adaptation and seed-production purposes.

Other work of the Bureau of Plant Industry bearing on range research includes important taxonomic studies stemming from the pioneer work of early-day botanists in the Department. The Department's work in systematic botany now is chiefly centered in the Division of Plant Exploration and Introduction, of which Benjamin Y. Morrison is in charge. This same division is also responsible for the introduction of foreign plants which may prove suitable for planting on range lands.

Federal research in the field of range rodents, predators, and game is conducted by the Fish and Wildlife Service of the Department of the Interior, which also assigns experts in forest and range biology to work with the six western forest and range experiment stations. This field of research, in which several States are also actively engaged, has a long and absorbing history of its own beyond the scope of this paper.

The present period is also characterized by somewhat more specialized studies pertaining to range-land use and management by the western State agricultural experiment stations. Practically all of the agricultural experiment stations in the Western States have studies relating in one way or another to range and pasture lands. Some of these originated in the earlier periods, and have been carried for a number of years, while many have recently been started. These studies have materially aided in the building up of necessary basic information for the sound guidance of use of range and pasture lands and livestock husbandry.[47]

and John A. Stoehr, "Comparison of Rambouillet, Corriedale, and Columbia Sheep under Intermountain Range Conditions," *Circ. 308* (1934); W. H. Black, and others, "Effect of Different Methods of Grazing on Native Vegetation and Gains of Steers in Northern Great Plains," *Tech. Bul. 547* (1937), "Wintering Beef Cows on the Range with and Without a Supplement of Cottonseed Cake," *Tech. Bul. 603* (1938), and "Wintering Steers on Different Planes of Nutrition from Weaning to 2½ Years of Age," *Tech. Bul. 667* (1939); M. X. Sullivan, and others, "Comparison of the Wool and Skins of Full-Fed and Maintenance-Fed Lambs," *Jour. Agr. Res.*, 61:877–886 (Dec. 15, 1940); W. V. Lambert and Fred F. McKenzie, "Artificial Insemination in Livestock Breeding," *Circ. 567* (1940); James O. Grandstaff, "Wool Characteristics in Relation to Navajo Weaving," *Tech. Bul. 790* (1942); and Maurice S. Shahan and Ward T. Huffman, "Diseases of Sheep and Goats," *Farmers' Bul. 1943* (1943).

[46] On February 13, 1943 the Bureau of Plant Industry became the Bureau of Plant Industry, Soils, and Agricultural Engineering, but in this paper it has been called by its original name.

[47] Some of the publications characterizing the work of the State agricultural experiment stations during this period include: H. C. Hanson, "Improvement of Sagebrush Range in Colorado," Colo. Agr. Expt. Sta., *Bul. 356* (1929); C. E. Linney, and others, "Climate as it Affects Crops and Ranges in New Mexico," N. Mex. Agr. Expt. Sta., *Bul. 182* (1930); J. L. Lush, and others, "Normal Growth of Range Cattle," Tex. Agr. Expt. Sta., *Bul. 409* (1930); K. P. Pickrell and E. B. Stanley, "An Economic Study of Range Sheep Production in Arizona," Ariz. Agr. Expt. Sta., *Bul. 134* (1930); O. A. Beath, "Poisonous Plants of Wyoming," Wyo. Agr. Col., *Ext. Circ. 37* (1931); H. C. Hanson, and others, "Effects of Different Systems of Grazing by Cattle upon a Western Wheatgrass Type of Range near Fort Collins, Colorado," Colo. Agr. Expt. Sta., *Bul. 377* (1931); M. H. Saunderson and D. E. Richards, "Types of Ranches and Operating Practices in Relation to Costs, Investment, and Income in the Range Beef Cattle Industry of Montana, preliminary report," Mont. Agr. Expt. Sta., *Bul. 244* (1931); C. P. Wilson, "The Artificial Reseeding of New Mexico Ranges," N. Mex. Agr. Expt. Sta., *Bul. 189* (1931); G. H. Hart, and others, "Seasonal Changes in the Chemical Com-

Throughout the later development of range research the ecological studies of universities and colleges have aided materially in extending the knowledge of basic ecological relationships, invaluable in furthering more practical studies. A notable example is the work of John E. Weaver and his students at the University of Nebraska, who have done a prodigious amount of research on ecological succession of the prairies with special emphasis on root systems of native prairie plants.[48]

In addition to the more specific range research, the current period is characterized by administrative studies and tests of several Federal agencies dealing with the various phases of range-land use. The quickened interest in range lands, both private and public, brought forth several new Federal agencies having responsibilities in the administration of the range and also enlarged the responsibilities of existing agencies dealing with range lands. This situation, resulting in the facing of new range problems, necessitated administrative checks and studies of range-management principles for local adaptation and use. Characteristic of these are the Soil Conservation Service range trials published in several Department bulletins, the Agricultural Adjustment Administration range-practice tests, the summarization and analysis of economic information having a bearing on range land by the Bureau of Agricultural Economics, and the range trials of the Grazing Service and the Indian Service of the Department of the Interior. In recent years, the Grazing Service has cooperated with the Oregon Agricultural Experiment Station in range-grazing trials at the Squaw Butte area near Burns, Oregon. The Grazing Service in 1941, with the assistance of Mont A. Saunderson of the Forest Service, completed an appraisal of grazing district lands as a basis for the establishment of grazing fees.

INFLUENCE OF WORLD WAR II ON RANGE RESEARCH

With the major upheaval of governmental activities and civilian life attendant upon the entry of the United States into World War II, an important phase of the period of range-research expansion begun in 1928 was completed, and a new phase was begun. In fact, it is more than likely that an entirely new period began in 1941, with the going of most younger workers to the armed forces, reductions in emergency funds, and the redirection of the whole range-research effort toward needed wartime production of livestock and direct assistance to the armed forces.

Range-research staffs and programs have been

position of Range Forage and Their Relation to Nutrition of Animals," Calif. Expt. Sta., *Bul.* 543 (1932); C. A. Brennen, and others, "The Main Reasons Why Range Cattle Ranchers Succeed or Fail, Cattle Production Costs per Head and Pound, 1928 to 1932 Figures and Long-Time Averages," Nev. Agr. Expt. Sta., *Bul. 133* (1933); J. L. Lantow, "The Assimilations of Calcium and Phosphorus from Different Mineral Compounds and their Effect on Range Cattle," N. Mex. Agr. Expt. Sta., *Bul. 214* (1933); J. H. Christ, "Reseeding Burned-Over Lands in Northern Idaho," Idaho Agr. Expt. Sta., *Bul. 201* (1934); A. E. Aldous, "Management of Kansas Permanent Pastures," Kans. Agr. Expt. Sta., *Bul. 272* (1935); M. H. Saunderson and Louis Vinke, "The Economics of Range Sheep Production in Montana," Mont. Agr. Expt. Sta., *Bul. 302* (1935); C. E. Fleming, and others, "Ranch and Range Balance, the Public Lands and Ranch Stability in Nevada," Nev. Agr. Expt. Sta., *Bul. 142* (1936); A C. Esplin, J. E. Greaves, and L. A. Stoddart, "A Study of Utah's Winter Range, Composition of Forage Plants and Use of Supplements," Utah Agr. Expt. Sta., *Bul. 277* (1937); W. E. Watkins, "The Calcium and Phosphorus Contents of Important New Mexico Range Forages," N. Mex. Agr. Expt. Sta., *Bul. (Tech.) 246* (1937); E. B. Stanley, "Nutritional Studies with Cattle on a Grassland-Type Range in Arizona," Ariz. Agr. Expt. Sta., *Tech. Bul. 79* (1938); A. F. Vass and Robert Lang, "Vegetative Composition, Density, Grazing Capacity and Grazing Land Values in the Red Desert Area," Wyo. Agr. Expt. Sta., *Bul. 229* (1938); L. A. Stoddart, and others, "Range Conditions in the Uinta Basin, Utah," Utah Agr. Expt. Sta., *Bul. 283* (1938); C. E. Fleming, and others, "Range Sheep Production in Northeastern Nevada: Production and Earning Power, 1933–1938, inclusive; long-time situation, 1910–1938," Nev. Agr. Expt. Sta., *Bul. 151* (1940); T. E. Brinegar and F. D. Keim, "The Relations of Vegetative Composition and Cattle Grazing on Nebraska Range Land," Nebr. Agr. Expt. Sta., *Res. Bul. 123* (1942); J. A. Gorman, and others, "Crossbreeding for Lamb and Wool Production," Wyo. Agr. Expt. Sta., *Bul. 254* (1942); C. B. Hutchison, and others, "The San Joaquin Experimental Range," Calif. Agr. Expt. Sta., *Bul. 663* (1942); and L.A. Stoddart and A. D. Smith, *Range Management* (New York and London, 1943).

[48] John E. Weaver, "The Ecological Relations of Roots," Carnegie Inst. Wash., *Pub. 286* (1919), "The Prairie," (with T. J. Fitzpatrick), *Ecological Monographs*, 4:113–295 (1934), and "Effects of the Great Drought on the Prairies of Iowa, Nebraska, and Kansas," (with F. W. Albertson), *Ecology*, 17:567–639 (1936).

streamlined to aid sustained war production through technical assistance on war boards and agricultural production programs for meat, hides, and wool from the range territory; through the preparation of practical management guides for stockmen and range administrators; and through short-time studies of urgent wartime problems, such as time of seasonal maximum condition of animals on range.

Assistance is given the Army and Navy in camouflage and protective plantings on airfields and other military establishments. Assistance is also given the Emergency Rubber Project through assignment of trained technical personnel and assistance in planning and organizing production programs for guayule, kok-saghyz, and other rubber-bearing plants. On long-time experiments there are maintained only the essential records, loss of which would hamper current and post-war application of research results.

Facts available for sound range-livestock production are now far more adequate than during World War I when patriotic but ill-advised overexpansion of numbers of cattle and sheep failed to accomplish the desired increase in essential livestock products. A backlog of thirty-five years of experience in range research in one form or another, the coordinated regional range research of the Department of Agriculture, the range work of the several State agricultural experiment stations, and the range-adaptation trials and tests of action agencies of the Department of Agriculture and the Department of the Interior greatly improve the prospects for sustained production of meat, hides, and wool needed by the United States in World War II.

There is a much better and more widespread understanding of the four basic principles of range management: proper kind and class of livestock, proper season of grazing, proper distribution of grazing, and proper numbers of animals. The development of range-survey methods has made possible the inventory of ranges and provided a base for preparation of management plans for wide application of improved practices based on the four underlying management principles. Grazing is being harmonized with watershed protection, timber production, and other land values.

Thousands of ranchers are practicing deferred grazing on their private ranges, reseeding depleted ranges, and adjusting rate of stocking to grazing capacity. Water facilities have been installed and fences built under public range programs, particularly those of the Agricultural Adjustment Agency. Detailed land-use plans have been developed and are in operation on millions of acres under the Soil Conservation Service program. Management plans are completed and in operation for some 7,000 of the 9,000 cattle and sheep allotments on national forests. Better and more conservative range management is in effect generally on the grazing districts, Indian reservations, and State and other lands. Perhaps most important of all is the general acceptance of the need for conservative range grazing for sustained forage and livestock production. All these highly propitious circumstances supporting wartime use of the range reflect in some degree the translation of research results into terms of range betterment and more economic livestock production.

When the war emergency is over and the world economy is gradually adjusted to peacetime pursuits, one thing is clear. Changed biological, economic, and social conditions will present perplexing range-production problems requiring comprehensive research for their solution. An intensification of the range research already under way will be needed, as well as an extension of existing studies to develop needed management practices in types and regions where there has been little previous study. Finally, there will undoubtedly be a much greater exchange of range-research ideas and workers between the continents than previously, a procedure with beneficial results in world order equally important to the technical advances.

NEWS NOTES AND COMMENTS

THE 1944 ANNUAL MEETING

The Agricultural History Society held its twenty-fifth anniversary meeting at the American Legion Club, 2437 Fifteenth Street, N.W., in Washington, D. C., on the evening of February 14. Forty-nine members and guests attended. Professor James C. Malin, the Society's president, presided.

The annual business meeting began with the reading of the minutes of the preceding annual meeting. President Malin then reported on the joint meetings with the American Farm Economic Association at St. Louis on September 16, 1943 and with the American Historical Association in New York City on December 29, 1943. He also

stated that Dr. Robert G. Dunbar, Dr. Earl W. Hayter, Dr. Guy Lee, and Lieut. R. C. Loehr had served with Vice President T. R. Schellenberg as the Membership Committee. The report of this committee was filed with the secretary-treasurer. President Malin also stated that he had nominated Dr. Schellenberg to represent the Agricultural History Society on the National Agricultural Jefferson Bicentenary Committee. The report of the editor of *Agricultural History* was then distributed to the membership present.

The report of the secretary-treasurer, Dr. Arthur G. Peterson, was read and approved. The Society's mailing list as of February 14 included 402 paying members, 11 life members, and 25 exchanges, or a total of 438, compared with 408 on April 10, 1943. The report of the auditing committee, consisting of Mr. Charles A. Burmeister (chairman), Dr. Richard O. Cummings, and Mr. Robert E. Post was accepted.

In accordance with the resolution adopted on April 27, 1943, the secretary-treasurer submitted prints of the seal as approved by the executive committee. It was voted that the Society thank those who designed and prepared the seal.

The results of the balloting for officers for 1944–45 were announced as follows: president, Dr. Arthur G. Peterson; vice president, Dr. Joseph C. Robert; secretary-treasurer, Mr. Charles A. Burmeister; executive committee, Dr. V. Alton Moody and Dr. J. Orin Oliphant. This election was in accord with the recommendations of the nominating committee consisting of Mr. R. G. Hainsworth (chairman), Dr. Lewis E. Atherton, Dr. F. E. Balmer, Dean Harry J. Carman, and Dr. Earle D. Ross.

Mr. Everett E. Edwards, as secretary of the National Agricultural Jefferson Bicentenary Committee, spoke briefly concerning the activities commemorating Jefferson's contributions to agriculture. The Society's executive committee was authorized to take whatever action it deems desirable with reference to the Society's participation.

Following the business meeting, President Malin introduced two of the founders of the Society, namely Dr. Lyman Carrier and Dr. O. C. Stine, who spoke briefly concerning the early years and future prospects of the Society. A motion that their statements shall be retained in the Society's archives was voted. Three other charter members, namely Dr. Edmund C. Burnett, Miss Cora L. Feldkamp, and Dr. John H. Martin, and three past presidents who were present, namely Dr. Solon J. Buck, Mr. Everett E. Edwards, and Mr. Herbert A. Kellar, were introduced.

After a recess, the membership reassembled for the program. Mr. Everett E. Edwards presented a report on "Objectives for the Agricultural History Society during Its Second Twenty-Five Years." On the suggestion of Dr. Solon J. Buck, this prospectus is to be printed in *Agricultural History*, together with a request for comments by the members for succeeding numbers. Dr. J. Clyde Marquis gave an informal talk on "The Need and Possible Ways of Making the Study of Agricultural History International in Scope." Professor Malin concluded the program by reading his presidential address, the subject being "Space and History."

SECRETARY-TREASURER'S FINANCIAL STATEMENT
JANUARY 1–DECEMBER 31, 1943

Balance on hand, Jan. 1, 1943:			
Checking account at McLachlen Banking Corporation			$288.71
Checks for deposit			38.25
Stamps			.30
Interstate Building Association			64.11
Receipts:			
Membership dues			
1942	$19.50		
1943	807.29		
1944	341.21		
1945	4.50		
Life	27.00	$1,199.50	
Back number sales		496.50	
Reprints		103.25	
Refund on paper purchase		12.58	
Interest (3 6-month periods)		3.25	
Special gifts for printing		59.40	
Total receipts			1,874.48
Total receipts plus Jan. 1, 1943 balance			$2,265.85
Disbursements			
Printing			
4 issues of journal	$1,147.03		
Reprints from 5 issues	140.98		
Miscellaneous	10.60	$1,298.61	
Postage			41.39
Stationery and supplies			8.25
Freight			4.12
Telegram			.41
Joint membership dues to Economic History Association			5.00
Bank service charges			.25
Metal seal			3.29
Total disbursements			$1,361.32
Balance on hand, December 31, 1943			
Checking account at McLachlen Banking Corporation, less outstanding checks	$837.17		
Interstate Building Association	67.36	904.53	
Total accounted for			$2,265.85